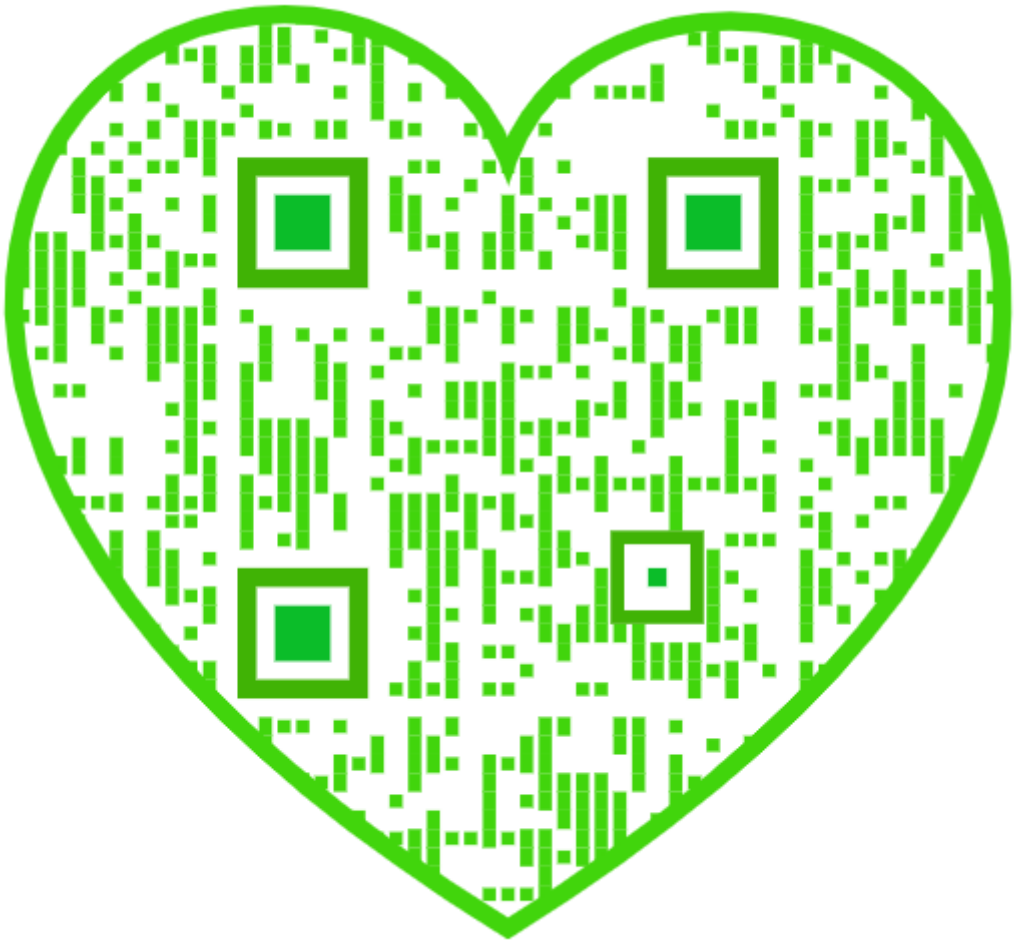

THE

GRASSES

OF

GREAT BRITAIN;

ILLUSTRATED BY

JOHN E. SOWERBY,

ILLUSTRATOR OF "ENGLISH BOTANY," THE "FERNS OF GREAT BRITAIN," "WILD FLOWERS WORTH NOTICE," ETC.

DESCRIBED, WITH OBSERVATIONS ON THEIR NATURAL HISTORY AND USES,

BY

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THE

GRASSES OF GREAT BRITAIN.

INTRODUCTION.

Among the numerous and diversified forms of the vegetable creation there is one most remarkable; as well for the extent of surface occupied by its countless millions of individuals, which, owing to their preponderance under almost every condition of soil and climate, may be said to bestow its hue and character upon the "broad green earth," as for its importance in the vast economy of Nature. This form, characteristic of an extensive order or family of plants, comprising about four thousand known species, is distinguished in our English language by the name of Grass, the indigenous species of which constitute the subject of the work before us.

The term *Grass* is occasionally employed in a much more comprehensive sense than is here admitted, especially by the farmer; who, accustomed to regard it as synonymous with green food for cattle of any description, applies it, nominally at least, to Clover, Sainfoin, and other plants cultivated for a similar purpose; while, at the same time, he may probably exclude from the series, species naturally associating with it by correspondence in structure, simply on account of their different agricultural adaptation. The mere cursory observer, misled by certain resemblances in general aspect,

may in like manner err as to the limits of this great family of vegetation, by confounding with it Sedges, Spike-rushes, and a host of plants which, organically considered, are as distinct from Grasses as an elm is from an oak. Allowing, however, for such circumstances, which are rather the results of convenience on the one hand and of inattention on the other, the group of plants here illustrated is as well defined, as decidedly separated from the other grand divisions of the vegetable kingdom, as in the animal are birds from mammals, or reptiles from fishes. Such, indeed, is the uniformity of appearance throughout the tribe, that, while other races of plants have been, almost universally, confounded by the writers of antiquity, or only distinguished by their difference of habit, as *trees* and *herbs*, the Grasses have found a name in every tongue and time from the earliest periods of human record or tradition. This distinction, indeed, is made in the most ancient of existing Books, where we are informed that, on the third day of creation, "the earth brought forth Grass, and herb yielding seed after his kind, and the tree yielding fruit,"—the sacred and learned historian employing the popular phraseology and simple classification of his time and people.

Now that Botany has assumed the rank of a science, and a closer inquiry into the structure and properties of plants demands a more extended system of arrangement than previously answered the purposes of the naturalist and others concerned in their study, it is essential that we should analyse the characteristic features, upon which the separation of a Grass from other grass-like vegetation depends. In a book intended for general reference, it would be well to avoid all technical phraseology; but, as we must examine and describe parts and organs that have no familiar English names, this is only possible to a limited extent. By a passing explanation, however, of the terms employed, or, in the absence of this, by reference to the short glossary which follows the present introduction, the author trusts to convey to the uninitiated reader the

leading and unmistakeable attributes of a true Grass; sufficiently so, at least, to render his after-descriptions intelligible to one not a botanist.

Every Grass, properly so called, has its stem cylindrical and jointed at intervals throughout, the erect or ascending portion, the Culm or straw, being, almost universally, hollow between the joints. The leaves, which spring from these joints only, have their lower part, which corresponds to a flattened leaf-stalk, rolled around the stem in the form of a sheath; and the upper or spreading portion, the true leaf, is usually long, narrow, and tapering to a point; it is always separated from the sheath by a projecting membrane, or a row of hairs or bristles, more frequently by the first, which is known, among botanists, by the name of Ligule, from the Latin *ligula*, a spoon or scoop, which this little appendage, in many of the Grasses, somewhat resembles; or, if we consider *ligula* itself to be derived from *lingua*, a tongue, the similarity in outline will not be the less obvious in other instances.

The flowers of the Grasses are variously arranged: in some cases they are disposed in loose, more or less spreading bunches, termed Panicles, as in the Millet Grass, Plate XX.—in others they form compact masses, denominated Spikes, which may be either short and rounded, as in the Hare's-tail Grass, Plate XIX., or long and slender, as in the Meadow Cat's-tail Grass, Plate XIII. These flowers are very different from those of most other vegetable tribes; never presenting either the bright hue or the symmetrical disposition of their parts, which excites our admiration in many of the higher orders of flowering plants. The organs which, in the flowers of the Grasses, represent those constituting the richly-varied cup of the Tulip, or the azure and silver bells of the Campanula, have here a totally different character and disposition. They are small, dry, membranaceous scales; never arranged two or more upon the same plane or level, but each occupying its own on alternate sides; being inserted in every instance a little above

or below each other, the lower one partially overlapping and enclosing the base of the upper.

The outermost scales investing the flowers of a Grass are termed Glumes, from the Latin *gluma*, husk or chaff; there are usually two of them, but in some instances only one, and in different Grasses they contain either one, two, or several flowers. Each flower considered apart, consists of two scales, or, rarely, of one only; these are, generally, shorter and of a thinner texture than the Glumes, and are called Paleæ, a Latin word nearly synonymous with *gluma*. Arising from the back of the Glumes and Paleæ, we frequently find a peculiar bristle- or hair-like process, denominated an Awn, an appendage which in some Grasses is of considerable length: examples of the Awn, on the back of the Palea, may be seen in the Fox-tail Grasses, Plates IV. to IX., magnified figures *b*; and in the Feather Grass, Plate XXII., in which its great ultimate length and condition constitute the most striking feature of the species.

Within the Paleæ are the Stamens, the male organs of the flower; each of these consists of a slender thread, called the Filament, bearing a broader, usually oblong, coloured body attached transversely on its summit—this is the Anther, which, in all the Grasses, is notched at both ends, and, owing to its attachment by the middle to the point of the Filament, upon which it turns as on a pivot, it is said to be *versatile*.

The number of Stamens contained in each flower is usually three, but in many of the Grasses of warm climates there are six, or even a greater number; while in a few instances we find only one or two. The Sweet-scented Vernal Grass, Plate I., is the only British species in which all the flowers have constantly only two Stamens; though a similar deficiency from the normal number occurs among those of certain others, in which some of the flowers present three Stamens, while others have but two, or, rarely, one only.

The centre of the flower is occupied by the Pistil, the base of which, a small oblong or rounded body, is termed the Ovary or Germen, and becomes when ripe the fruit, consisting of a case including a single seed. The fruit of a Grass, being inseparable from the seed, is only recognized by the botanist, the term Seed or Grain being that by which it is generally distinguished. From the summit of the Ovary extend, in most instances, two slender processes, the Styles, which usually terminate in more or less feather-like extremities, the Stigmas.

All the parts above described are illustrated in our magnified figures, and, in most of the plates, the Glumes are marked by the letter *a*, the Paleæ or separate flower by *b*, while *c* represents the Pistil. The Stigmas of the last are often very beautiful microscopic objects.

Other features are observable, by close investigation, in the flowers of many of the Grasses; but, however interesting to the scientific botanist, as associated with his theories of floral structure, they are not, at present, available for the purposes of classification, and consequently of no importance to the general observer, for whose assistance alone this description is intended. The persevering student, desirous of extending his acquaintance with the plants before us, beyond the capability of distinguishing species, cannot do better than consult, for details not appertaining to our plan, the "Vegetable Kingdom" of Dr. Lindley, article "Graminaceæ," where the leading views and theories of Grass-structure are quoted and discussed at a length incompatible with the limits of this work.

The contents of the Glumes are styled Locustæ or Spikelets. I have adopted the latter term; describing the Spikelets as being one-, two-, or more- flowered, signifying that so many perfect flowers will be found within each pair of Glumes. By a perfect flower is generally understood, one containing Stamens and Pistil; but these organs are not always both present within the same

Paleæ. The deficiency occurs, accidentally, in some flowers of several British Grasses; but in many of those belonging to tropical or warm climates the flowers are constantly unisexual, or bear Stamens and Pistil separately, the two kinds being in many instances very different in appearance and in relative disposition. We have a familiar example of this in the Maize or Indian Corn, in which the male or stamen-bearing flowers are produced in panicles at the top of the stem, while the female or fruit-bearing form their large, compact, cylindrical spikes within the bases of the lower leaves.

In certain Grasses, the Paleæ eventually become altered in texture, hardening and contracting around the ripening grain, and seeming to constitute a portion of its integument; this circumstance is occasionally noticed in the descriptions.

Though exhibiting throughout, as above detailed, a marked uniformity of general structure; in a group of such vast extent and universal distribution, occupying every range of temperature from the most extreme of polar lands to those under the equator, and from the low ocean-shores of the tropics to the alpine limits of perpetual frost, individual character may be supposed to vary considerably. In no instance is such difference more strikingly evinced than in stature. Some of the most diminutive Grasses of barren and exposed situations in cold countries scarcely exceed an inch in height, while the most majestic of the tribe belonging to the torrid zone, the common Bamboo of India, is said sometimes to attain more than a hundred feet, and the growth of other species of the same and corresponding lands to reach fifty or sixty feet. The erect stems of our British Grasses are only of annual, or rather summer duration; but those of warmer climates, and especially of the larger kinds, are often perennial, some even retaining this character when cultivated in the English garden. Whatever may be its size or duration, the Grass-stem is always proportionally slender in comparison with its elevation above the soil; but it is

strengthened by a copious deposit of silica or flint-earth, lodged in the cells of its cuticle or skin. The quantity of this substance is often sufficient to maintain the form of the part to which it appertains, when all the vegetable matter has been removed by burning, or otherwise; a circumstance well known to microscopic observers, who obtain by so doing beautiful objects for polarization. The earth in question is elaborated from the soil by the roots of the plant, being probably retained in its nutritive juices in a fluid state through its affinity with potash, as a silicate of that alkali. The hardness of the exterior of the fruit or grain, which in some instances equals that of agate, as in that of *Coix Lachryma*, an East Indian grass, called from its form and pearly lustre Job's-tears, is due to a similar deposit. The silica is frequently lodged in considerable quantity in the joints or nodes of the stem, contributing greatly to strengthen that of the larger kinds; and in the Bamboos it often finds its way into the hollows above them, probably through perforations made by insects, where it constitutes the substance called in Persia and India *tabasheer*. The vitrified matter left by the burning of corn and hay-stacks, is due to this necessary element of grass-composition; a fact capable of demonstration by subjecting the ashes of almost any grass-stem to the action of the blow-pipe, under which globules of glass may be obtained, varying in hue according to the species employed; that from Wheat-straw being colourless, and, if properly managed, transparent; while the straw of Barley yields it of a brilliant topaz-yellow, and that of the Oat of a pale straw-colour;—the hue, however, is not, judging from my own experience, to be depended upon, as I have several times obtained a perfectly colourless globule from Barley-straw. The result is probably dependent upon accidental circumstances.

The aggregate value of the Grasses, as affording the principal food of herbivorous animals, especially of those in the subsistence of which we are the most interested, is greatly enhanced by the

application of the seeds of many to the support of mankind; an application of such distant origin as to be not only beyond the earliest annals of our race, but even to figure as a myth in the traditions which preceded them, and to occasion the practice of agriculture, among all the nations of antiquity, to be deduced from the teachings of a God.

The Cereal Grasses, as the different species so employed are sometimes termed, more familiarly known collectively as Corn, constitute but a very small proportion of the thousands included in the tribe before us; but their immediate and widely-extended influence upon human economy, as accompaniments of advancing civilization in every age and country, renders them of paramount interest, compared with their smaller-seeded associates forming the promiscuous vegetation of the natural pasture. The mythic origin of their cultivation associates strangely with that of their own natural history, which still remains untraced from the wild state, in all the most important species that constitute the staple food of nations or of races; unless the assertions of M. Esprit Fabre, of Agde, in regard to that of Wheat, be found, by other experimentalists, decisive of our staple bread-corn being an altered form of a Grass hitherto regarded by botanists generically distinct. Should this fact be substantiated, a new and important field would be laid open to speculative industry, as to the possible modification of other wild Grasses; and thus render many, which are at present useless in the pasture, objects of interest as adapted for a different and higher sphere of utility. In the mean time, none of the kinds of Grain, with which we are now familiarly acquainted as objects of cultivation, are recognized beyond its pale, unless as solitary and temporary productions from seeds of chance distribution. While other Grasses, whether annual or perennial, obtain, under a similar dispensation, a permanent local attachment to the soil upon which they may have intruded, the Wheat, Barley, Oat, Rye, Maize, &c. are, unless fostered by the management of

man, only the passing tenants of a season. In some of them at least, neither change of climate nor treatment under cultivation, during thousands of years, has wrought any important alteration in general character. Like other Grasses and higher groups of vegetation, they have, all, their geographical limits, beyond which even human art cannot force their production; but, although those limits are wide, and the natural phenomena they embrace are varied, the grain matured under the rainless and burning skies of Egypt, and that of the same species ripened in Northern Europe, differ no more than varieties which may be reared upon the same field.

The supposed improvement of the Cereal Grasses, from species less productive in the natural state, is perfectly consistent with changes induced by culture on other plants; but it is an important fact in their history, that the original modifications should have been results of corresponding ideas and successful experiments, among peoples whose careers and circumstances were widely dissimilar, and whose efforts were neither simultaneous nor exercised upon the same objects, though in every instance leading to a similar consummation—namely, the production of vast and continuous supplies of vegetable food from sources individually so insignificant. We may readily understand the early appreciation, for such purpose, of certain fruits, conspicuous as to size and abundantly brought forth, as the date, the cocoa, and the fig, or those of the plantain and banana; similar reasons operated in directing attention to the nutritive character of the more succulent roots, and the seeds of the various kinds of pulse. But, that race after race of mankind should have adopted Grass-seeds as its principal supporting medium, as its main staff of life; and pursued their cultivation, until it became a science involving the subsistence of hundreds of millions, demanding laws for its protection, and engrossing the paramount consideration of kings and governments, is one of the most marked characteristics of human progress. By

the Caucasian and Mongolian races, the different varieties of Wheat and Barley have been cultivated from times immemorial, and the former, especially, has transported them into every country it has penetrated, where the temperature is neither too high nor too low for their development; where the first is the case, Rice and Millet constitute the vegetable diet of these races, as well as those of the Negro and Malay. The Maize, or Indian-corn, although long since introduced by European commerce into various parts of the eastern continent, was unknown by us until the discovery of America, where, like the Wheat and Barley, it was only met with under cultivation, and distributed along a line which tradition has recorded as the tract of the Toltecs; a tribe probably of Asiatic origin, that, migrating from the north-west to the table-land of Mexico, and penetrating far into the southern peninsula, laid the foundation of regular government, and the advanced state of civilization found by the Spaniards on their arrival at the countries in question.

The agricultural associations of all these kinds of Corn, as affected by climate and other circumstances, are among the most important facts appertaining to the history of the tribe of plants before us. The necessary limits of this introduction will not admit of details; but a few short extracts from Schouw, a Danish writer on the geographical distribution of plants, as published some years back in Jameson's Edinburgh Journal, will furnish sufficient information on the point in question to satisfy the general reader:—

"Within the northern polar circle, agriculture is only found in a few places. In Siberia, grain reaches at the utmost only to the latitude of 60°; in the eastern parts, scarcely above 55°; and in Kamtschatka there is no agriculture. Only in Europe, namely in Lapland, does the polar limit of agriculture reach an unusually high latitude, 70°. The grains which extend farthest to the north of Europe are Barley and Oats. These, which in the milder climates are not used for bread, afford to the inhabitants of the

northern parts of Norway and Sweden, of a part of Siberia and Scotland, their chief vegetable nourishment.

"Rye is the next grain which becomes associated with these. This is the prevailing corn in a great part of the northern temperate zone, namely, in the south of Sweden and Norway, Denmark, and in all the lands bordering on the Baltic, the north of Germany, and part of Siberia. In the latter another very nutritious grain (not a grass), Buckwheat, is very frequently cultivated. In the zone where Rye prevails, Wheat is also generally to be found, Barley being here chiefly cultivated for the manufacture of beer, and Oats supplying food for horses.

"To these there follows a zone in Europe and Western Asia, where Rye lessens, or disappears, and Wheat almost exclusively furnishes bread. The middle and south of France, England, part of Scotland, a part of Germany, Hungary, the Crimea, and Caucasus, as also the lands of Central Asia where agriculture is followed, belong to this zone. Here the vine is also found (that is, on the continent); wine supplants the use of beer, and Barley is consequently less raised.

"Next comes a district where Wheat still abounds, but no longer exclusively furnishes bread; Rice and Maize becoming frequent. To this zone belong Portugal, Spain, part of France on the Mediterranean, Italy, and Greece; further, the countries of the East, Persia, Northern India, Arabia, Egypt, Nubia, Barbary, and the Canary Islands; in these latter countries, however, the culture of Maize or Rice, towards the south, is always more considerable; and in some of them several kinds of *Sorghum* (Indian and African Millet), and *Poa Abyssinica*, come to be added. In both these regions of Wheat, Rye only occurs at considerable elevations; Oats, however, more seldom, and at last entirely disappear; Barley affording food for horses and mules.

"In the eastern parts of the temperate zone of the old continent, in China, and Japan, our northern kinds of grain are very unfre-

quent, and Rice is found to predominate. The cause of this difference between the east and the west of the old continent appears to be in the manners and peculiarities of the people. In North America Wheat and Rye are grown as in Europe, but more sparingly. Maize is more reared in the western than in the old world; and Rice predominates in the southern provinces of the United States.

"In the torrid zone, Maize predominates in America, Rice in Asia, and both these grains in nearly equal quantity in Africa. The cause of this distribution is, without doubt, historical; for Asia is the native country of Rice, and America of Maize. In some situations, especially in the neighbourhood of the tropics, Wheat is also met with, but always subordinate to other kinds of grain.

"In respect of the predominating kinds of grain, the earth may be divided into five grand divisions or kingdoms:—the kingdom of Rice, of Maize, of Wheat, of Rye, and lastly, of Barley and Oats. The first three are the most extensive: the Maize has the greatest range of temperature, but Rice may be considered as supporting the largest number of the human race."

With a single positively determined exception in the *Lolium temulentum* or Bearded Darnel Grass, and a few other alleged, but scarcely substantiated instances of deleterious character, the seeds of the Grasses are wholesome, and vary only in degree as to their nutritive qualities: hence the original selection of the kinds cultivated as Corn seems rather to have been a consequence of the larger size of the grain, and experience of its palatability and ready conversion into meal, than of necessity. In agreement with this view, many other Grasses have acquired local or occasional value in cultivation, owing to the abundance in which their small seeds are matured, and the facility of their growth and collection. Among these are some species of *Panicum* and *Setaria*, especially *Panicum miliaceum*, and *Setaria Italica* and *Germanica*, the seeds of which are used as Millet in the south of Europe. In certain districts in the East Indies, and in Africa, other kinds are occasionally met with under

culture, but only to a very trifling extent compared with the ordinary and familiar species of Corn. In the wild state, *Zizania aquatica,* the Canada Rice, Wild Rice, or Tuscarora Grain, is an important species of Grass, bearing large seeds adapted for food: it grows abundantly in the shallow streams, lakes and pools of North America, where the seeds are collected and used as Corn by the wandering Indian tribes of the north-west part of the continent, and furnish subsistence, in their season, to the countless flocks of wild geese, swans, and other water-fowl frequenting that region. Sir Joseph Banks introduced this Grass into England in 1793, and experiments were made upon its cultivation in Middlesex, Ross-shire, and some other parts of the kingdom, under the idea that it might prove useful as a crop in situations not adapted for rearing more valuable produce. But, though found to grow and ripen its seeds freely on the borders of our rivers, brooks, and ponds, no economical result has yet ensued, notwithstanding the prediction announced by Pinkerton nearly a century ago, that it seemed destined by Nature to become the bread-corn of the North.

In certain districts of India and Africa, other Grasses are occasionally seen under cultivation, but to a very trifling extent compared with the more familiar species and kinds of Corn.

One remarkable circumstance appertaining to the history of the Cereals is that all of them are annuals; and that, however valuable the foliage of many of the perennial Grasses may be for the maintenance of our flocks and herds, not any of them appear to have been cultivated, from the most distant periods down to the present time, with the view of employing their seeds as human food. Those of the common Feather Grass, *Stipa pennata,* are however said to yield a flour as palatable, and otherwise nearly resembling that of Rice; while chemical analysis shows those of several other species, belonging to the mixed vegetation of our fields and pastures, equal in nutritive contents to European Grain generally, Wheat alone excepted. The comparatively small size of the seeds has

been, probably, less the cause of this neglect than ethnological and agricultural prejudices in favour of the species first selected or introduced.

Next to the surpassing value of Grass foliage and seeds in the mass as food, the production of Sugar is no unimportant feature in our economical estimation of these plants. This substance, of which, according to computation founded upon the quantity annually imported for home use in this country, every individual among our vast population consumes about a quarter of a hundredweight yearly, though chiefly prepared from a single species, *Saccharum officinale,* exists in variable proportion in most Grasses; a fact readily perceptible by the taste, on masticating the joints of their stems, in which parts it is usually present in greater abundance than elsewhere, though occasionally constituting a very marked proportion of the substance of ripened Grain. In that of Barley especially, it equals seven or eight per cent. Notwithstanding these circumstances, however, as Sugar ranks, in combination with other proximate principles, as a nutritive matter belonging to vegetation collectively; apart from the cultivation of the above-mentioned species of *Saccharum,* and that of three or four other Grasses of warm climates, for the purpose of obtaining it in large quantities for economical use, its presence is not to be regarded as forming an essential characteristic of the Grass tribe.

The species of *Saccharum* are numerous, amounting to between thirty and forty, as described by botanists from different parts of the world, though our present rules for generic distinction are too artificial and arbitrary to admit of this estimation of their number being considered determinate. Cultivation has not hitherto been extended to more than four or five members of the genus, near allies, if not indeed mere accidental varieties of the common Sugar Cane, all of which are indigenous to India or China, though, as tropical Grasses, other species are found in the West Indies, South America, Africa, and the islands of the Pacific Ocean.

The stems of the Sugar Cane present an exception, though far from being a solitary one, to the general character of the Grass stem, in not being fistular or hollow between the joints; a circumstance to which the abundance of juice yielded by them under pressure is chiefly due. This juice contains the Sugar, which is brought into a crystallizable state by boiling it with quick-lime to neutralize the oxalic and other vegetable acids associated in its composition. The interest attaching to a Grass-product that has now for more than two hundred years constituted an essential ingredient in the diet of all classes of the European race, in every part of the world over which it has extended, renders a glance at its history a necessary item in our general review of the extensive family of plants before us, however brief and limited the plan of our Introduction.

Neither record nor tradition affords any evidence concerning the period at which the cultivation of this important Grass was commenced, nor of the people among whom it was first practised. To the more ancient civilized nations of Europe, sugar seems to have been long unknown, honey supplying its place as food and condiment; and, when in later times, as commercial intercourse with the peoples of the East became extended, it reached them in small quantities, it was only employed as a costly medicinal agent to moisten the mouth in fevers, under the name of Indian Salt. Indeed, it was not until about the tenth century of the Christian era that its supply became sufficiently plentiful to supersede honey in the practice of physic, to which it was, during four or five centuries afterwards, almost exclusively confined, unless in those parts of Europe bordering upon the Mediterranean.

The Indian, or rather Sanscrit, name *Sarkara*, rendered by the Arabs, through whom it probably first reached our continent, *Sukhir* or *Soukar*, is little altered by its transference into the languages of modern Europe. In the times of the early Crusades the Sugar Cane grew in Syria; whence its cultivation was successively introduced into Italy, Spain, and the islands of the Mediterranean,

and afterwards into the Canaries and Madeiras, eventually being extended by the Portuguese to their settlements in Brazil, and by the Spaniards to the islands of the West Indies. The first English plantations were made in Barbadoes in 1643, and the year following in Jamaica. These parts of the western hemisphere, aided to some extent by corresponding importations from the east, now furnish the principal supplies of this useful article to the European markets; having almost entirely superseded the former cultivation of the reed in this quarter of the globe, although it is still planted and manufactured on a limited scale in some of the southern provinces of Spain; while in France the use of Beet-sugar, at first as the result of necessity during the long war and blockade of her ports, and since under the protection of the laws, has nearly supplanted the importation of that from the cane.

There cannot be any question as to the fact, that the production of Sugar from many other Grasses of large size and succulent character might be economically pursued. But in this respect, as in regard to the several kinds of Grain, habit and long experience have induced a predilection in favour of the *Saccharum*; while successive improvements in agricultural management and manufacture have placed it, as a producing medium, far in advance of those species which, under corresponding circumstances, might have been its successful competitors. The quantity of Sugar contained in the stems of the American Maize is so considerable, for instance, that its cultivation has been recommended as a substitute for that of the Sugar Cane, in climates unsuited to the growth of the latter. The very simple process by which the article in question is obtained from the sap of the *Acer saccharinum* or Sugar Maple, growing in the forests of Canada and the United States, added to the facility of importation and sufficiently low price of that of the West Indies and other parts, has hitherto prevented the experiment from being instituted on a scale of sufficient extent to render success determinate.

Medical opinion differs greatly in regard to the beneficial effect of Sugar as an article of food; many practitioners considering it highly deleterious, especially to persons of dyspeptic habit, on account of its tendency to generate acid in the stomach. That it fulfils, however, an important part in the nourishment of the higher animals which subsist, either wholly or partially, on vegetable substance, seems evinced by the natural fondness they exhibit for plants in which it abounds. The destruction of our growing seeds by birds is a consequence of their sweetness, one of the necessary results of germination; while the most nutritious Grasses, and those best appreciated by grazing animals, are all among the kinds which contain Sugar in the largest proportion. The enormous consumption of fresh Sugar-cane by the negroes and natives of the countries in which it is cultivated, and its effects upon the former during the cane harvest, when, in many places, they scarcely take any other kind of food, afford incontrovertible evidence of the value of this vegetable production; especially when used in combination with the gluten and other proximate principles that it accompanies in the juices of the plant, which is both masticated in the raw state and eaten boiled as a culinary preparation.

Apart from the utility of the Grasses as hitherto observed upon, their importance in the economy of Nature, as constituting a large proportion of the general vegetation in all countries, must not be overlooked. This proportion varies greatly in regard to the number of species, according to climate, presenting its highest grade in polar lands and descending as we advance towards the tropics. Thus the Grasses form nearly one-fifth of the scanty flora of Melville Island, in latitude 74° 46′ N., while within the torrid zone they scarcely average more than one-fifteenth.

The verdant covering of our earth's surface is associated with too many circumstances necessary to animal existence, independent of the food it furnishes, to admit of detail in this short treatise, influencing as it does, under its numerous modifications of forest,

heath, mead, and jungle, the condition of the atmosphere, the moisture, dryness, and even the temperature of climates; but, glancing at the subject only on the broad scale, the Grasses occupy a paramount position among their kindred forms. Owing to the social habit of growth of many kinds, they frequently cover the land to the almost total exclusion of other plants; immense tracts of country in both hemispheres, and in every zone of vegetation, presenting them alone as their grand characteristic feature. Even where apparently their absolute dominion is superseded, their slender stems and leaves are still seen, occupying every available opening between the broader masses of foliage, the exuberance of which seems to threaten annihilation to the bold intruder. The Grasses are indeed deserving of the title fancifully bestowed upon them by the great Swedish naturalist—they are the true *plebeians* of the vegetable kingdom, and may be said to constitute the broad understratum of its vast society of flowering plants; not as species, numerous as these may be, but in their countless myriads of individuals, and their extensive range of habitat from the equator to the poles—from the scorching sea-borders of tropical lands to the highest alpine limit of enduring frost. So circumstanced, in the plan of utilitarian Nature their influence has no more circumscribed bound than their distribution, nor is it less varied,—a fact which will be sufficiently exemplified in the following short history of British genera and species.

In describing some of the species, the term *viviparous* occasionally occurs, applied to certain variations of structure to which they are liable; and, although explained in the Glossary, the peculiarity it denotes is an adaptation so curious and striking to the ordinary observer, as to require a few general remarks in elucidation. A Grass is said to be *viviparous*, or producing alive, when, in place of flowers and seeds, it bears small leafy buds, which eventually drop off, and, rooting where they fall, produce young plants. The appearance of the Grass, in this case, is so much altered from its

normal or accustomed form, that, by an observer not familiar with the modification in question, it would possibly be mistaken for a different species. The flowering stems shoot up, terminating in the spiked or panicled form characteristic of their kind; but, as the glumes open, the deficiency of the floral structure quickly becomes apparent. The paleæ and stamens do not develope, though their rudiments may be present and, often, easily traceable; indeed those of the former are generally so, but so different in character from the corresponding organs in a seed-bearing plant as scarcely to be recognized. From the place of the pistil extends a little green leaf, from the sheathing base of which a second soon comes forth, like a Grass growing from its seed, excepting that the little plant thus produced is stronger and more rigid than those of seedling growth. Regarded in a physiological point of view, there is not anything to excite our surprise at a result so contrary to that of the flowering process, by which the species is multiplied under ordinary circumstances. Every flower is, strictly speaking, merely a condensed branch or stem, and each of its parts or organs a modified leaf, liable to develope as a common leaf when unrestricted by the peculiar conditions which compel it to assume a different form. Garden cultivation affords numerous instances of this liability to floral metamorphosis, every double flower decorating our parterres being an illustration of the passage of one set of organs into another. Our double roses are frequently disfigured, in the estimation of the florist, by presenting a green leafy centre, the result of an imperfect modification of the leaves which in the natural state of the flower would compose its pistils. I have succeeded in raising a rose-bush by planting such a production, which was truly only planting the terminal bud of a branch: the viviparous multiplication of a Grass is a parallel process in organic development.

It is, then, only the capability of our Grass to adapt itself to circumstances that is deserving of remark,—the wonderful plasticity of

living structure, and its power of adjusting the forces which life generates within it to the end required, that ought to challenge our admiration. We might search in vain the rich meadow, the level common, the moist hedge-bank or the wood for any instance of the kind. It is only on the dry and elevated rocky pasture, the table-land and the mountain-side, swept by bleak winds, that derange and interrupt the necessary functions of the delicate floral organs conducive to the production of seed, or where the short duration of summer heat is insufficient for ripening the latter, and afterwards of maturing the young plants to a degree of strength sufficient to enable them to withstand the enduring cold of regions so circumstanced, that Grasses assume the viviparous habit. This habit either involves or depends upon certain constitutional changes, and, being so, is maintained indefinitely, by the Grass and its offspring, in situations widely differing from those in which it was first acquired.

One or two examples of viviparous species will be found among our figures of British Grasses, and are given with the view, not only of illustrating this occasional peculiarity in those of alpine growth, but also of rendering its recognition in other species more familiar to the eye of the student by comparison with those now placed before him.

The detail of other circumstances connected with the history of the Grasses, but less general in their application to them as a tribe, would lengthen our Introduction to an extent disproportioned to that of the work; the reader is therefore referred, for further information on this head, to the descriptions of those families and species to which they are more immediately applicable.

To the adept and to the student of botanical science, the absence of obvious classification in the disposition of our figures and descriptions may appear a defect, and the propriety of such omis-

sion was a subject of no little consideration on the part of the author; but, himself unsatisfied with any existing systems of arrangement, which are all so artificial and uncertain that scarcely any two, among the more intelligent class of writers, seem agreed as to the limits of groups or the allotment of genera, it was determined to avoid interruption to the series of the latter in the body of the work, and rectify such omission by a tabular arrangement of them in the Introduction. The decision may, on the one hand, have its disadvantages; but, on the other, it has tended to render the book less fearfully technical than it would have been, had the continuity of the subject been disturbed by sectional paragraphs in italics, which, however useful to the persevering student, contribute much to perplex and even disgust the uninitiated reader.

The attempts to classify the Grasses, by associating the genera in natural groups, have been numerous; and some of the highest names in the annals of natural science are guarantees for the ingenuity and judgment exercised on the systems to which they have given existence. That of Endlicher may eventually become the basis of one less exceptionable than it is itself at present. Under it, the British Grasses, wild and cultivated, are distributed in the following tribes, the leading characters of which are given, followed by the names of the genera appertaining to each. Such characters will be more easily understood by reference to the magnified figures of the flowers on our Plates.

Tribe 1. Oryzeæ. *Rice family.*

Spikelets laterally compressed, one-flowered. Glumes absent. Paleæ two, enclosing, but not adhering to, the ripe fruit. Stamens three or six.

Leersia.

In *Oryza* itself, the Rice-plant, there are two glumes to the spikelet and the stamens are always six. *Zizania* and others furnish valuable farinaceous food in their seeds.

Tribe 2. PHALAREÆ. *Canary Grass family.*

Spikelets laterally compressed, with one perfect flower, and, frequently, one or even two others which are either male only or rudimentary. Glumes two, generally nearly equal. Palcæ often glossy and hardening over the fruit. Styles or stigmas elongated.

Phalaris.	Anthoxanthum.
Knappia.	Hierochloë.
Phleum.	Alopecurus.
Holcus.	

Some of our most common and most nutritious pasture Grasses belong to this tribe.

Tribe 3. PANICEÆ. *Millet family.*

Spikelets more or less dorsally compressed, with one perfect flower and, generally, the rudiment of a second. Glumes thinner than the paleæ, the lower one smaller, both occasionally abortive. Paleæ of a leathery or paper-like texture, usually awnless, the lower one concave.

Milium.	Echinochloa.
Digitaria.	Setaria.

Several species are cultivated in other countries on account of their farinaceous seeds; but, with the exception of *Milium*, the British species are of rare occurrence and unimportant.

Tribe 4. STIPEÆ. *Feather Grass family.*

Spikelets not compressed, one-flowered. Glumes nearly equal, membranaceous. Lower palea rolled inwards, awned at the apex, becoming indurated around the fruit in maturity. Awn simple or trifid, usually twisted, articulated at the base. Ovary stalked.

Stipa.

The seeds of some of these Grasses rival those of Rice in nutritive value; but the most conspicuous member of the tribe is *Stipa pennata*.

Tribe 5. AGROSTEÆ. *Bent Grass family.*

Spikelets one-flowered, rarely having the rudiment of a second flower above. Glumes and paleæ membranaceous; the lower palea usually awned. Stigmas generally sessile.

Agrostis.	Gastridium.
Apera.	Polypogon.

The typical genus is an important one on account of its extent and wide distribution, but they are not valuable meadow Grasses in the aggregate.

Tribe 6. ARUNDINEÆ. *Reed family.*

Spikelets either one-flowered or many-flowered. Flowers generally surrounded at the base by, or invested with, long soft hairs. Glumes and paleæ membranaceous; the former usually as long or longer than the flowers. Lower palea often awned.

Phragmites.	Calamagrostis.
Ammophila.	Deyeuxia.

Generally tall, coarse Grasses of no agricultural value, but of great importance in the economy of Nature as colonizers.

Tribe 7. CHLOREÆ. *Cord Grass family.*

Spikelets laterally compressed, one- or more-flowered; collected into unilateral spikes. Glumes and paleæ membranaceous; the latter sometimes awned; the former permanent on the rachis, and the anterior one inserted higher up than the other. Spikes digitate or panicled, rarely solitary. Rachis continuous, not jointed.

Cynodon.	Spartina.

The British species are only of local occurrence; their habit is that of colonizers. The greater portion of the tribe consists of annual Grasses belonging to warm climates.

Tribe 8. AVENEÆ. *Oat family.*

Spikelets two- or more-flowered; the terminal flower generally incomplete. Glumes and paleæ membranaceous. Lower palea mostly awned; the awn usually dorsal and twisted.

Aira.	Avena.
Corynephorus.	Trisetum.
Lagurus.	Arrhenatherum.

A valuable tribe as containing the cultivated Oats; but the British species are mostly hard, wiry Grasses, disliked by cattle, and apparently containing little nutriment.

Tribe 9. FESTUCEÆ. *Meadow Grass family.*

Spikelets many-flowered, rarely few-flowered. Glumes and paleæ membranaceous, rarely coriaceous; the lower palea generally awned, the awn not twisted. Inflorescence usually paniculate.

Sesleria.	Briza.
Triodia.	Catabrosa.
Kœleria.	Cynosurus.
Melica.	Dactylis
Molinia.	Festuca.
Poa.	Bromus.
Glyceria.	Serrafalcus.
Sclerochloa.	

The Grasses of this extensive tribe constitute a large proportion of the herbage of our meadows. They vary greatly in their nutritive properties; but many species of *Poa* and *Festuca* are among the most valuable belonging to northern climates.

Tribe 10. HORDEÆ. *Corn family.*

Spikelets one- or two- to many-flowered; the terminal flower incomplete. Glumes and paleæ herbaceous; the former occasionally deficient. Stigmas sessile. Ovary mostly hairy. Inflorescence spicate; spike simple, solitary; rachis rarely jointed.

Brachypodium.	Secale.
Lolium.	Elymus.
Triticum.	Hordeum.
Agropyrum.	Ægilops.

This tribe contains most of our Cereals or Corn Grasses.

Tribe 11. Rottboellæ. *Hard Grass family.*

Inflorescence spicate; the rachis in most instances jointed. Spikelets one- or two-flowered, lodged in hollows of the rachis; either solitary or in pairs, one being stalked. One of the flowers, where there are two, is generally incomplete or only rudimentary. Glumes one or two, or wanting altogether; usually coriaceous. Paleæ membranaceous, rarely awned.

Nardus.	Lepturus.

Coarse grasses, containing little nutritive matter, and hence useless in agriculture. The British species are insignificant.

The following synopsis of the genera, however exceptional it necessarily is in many instances, will assist in rendering the student's reference to description and figures more immediate and decisive, and greatly abridge the labour of comparison in detail. A small pocket lens, and a needle, or pointed penknife, are the only positive requirements for tracing the structure of a grass flower. The latter, it should be observed, is generally in the most favourable condition for examination immediately before the extension of the stamens; and a very little practice, commencing with some of the larger-flowered species, will remove all apparent difficulty in manipulation.

* *Inflorescence spicate. Spikelets one-flowered.*

Spikelets unilateral.

2. Nardus. — Without glumes. One stigma.

46. Knappia.—With two opposite glumes. Paleæ hairy, erose. Two stigmas.

Spikelets imbricated round the rachis.

1. Anthoxanthum.—Flowers diandrous; with two awned outer paleæ, one on each side of the flower.

4. Alopecurus. —Flower with a single palea, awned from the base.

5. Phalaris. —Flower with a palea-like scale on each side below, the presumed representatives of two others, as in *Anthoxanthum;* but distinguished from that genus by being triandrous.
P. arundinacea has a loosely panicled inflorescence.

6. Ammophila. —Flower with silky hairs at the base.

7. Phleum. —The inflorescence resembles that of *Alopecurus;* but the glumes are bristle-pointed, and the paleæ two and awnless.

8. Lagurus. —Glumes fringed and hair-pointed. Outer palea with two terminal hairs, and a long dorsal awn.

11. Stipa. —Spikelets few, distant. Outer palea investing the ripe fruit, and terminating in a long, twisted, and knee-bent feathered awn.

Spikelets alternate on opposite sides of the rachis.

40. Hordeum. —Spikelets three together on alternate sides of the notched and jointed rachis. Outer palea awned, investing the ripe fruit.

45. Lepturus. —Spikelets solitary, imbedded in the rachis, which separates at the joints. Glumes two, collateral.

** *Inflorescence spicate. Spikelets two- to many-flowered.*

24. Koeleria. —Spike rounded, interrupted below. Glumes shorter than the flowers.

25. Sesleria. —Spike rounded, compact. Glumes as long as the flowers.

27. Setaria. —Spike cylindrical. Spikelets surrounded by rough bristles.

34. Cynosurus. —Spike unilateral. Spikelets with pectinated bracts at the base.

39. Elymus. —Spikelets in pairs on a toothed rachis. Glumes two, collateral.

41. Secale. —Spikelets solitary, parallel to the rachis, with two fertile flowers, and a middle rudimentary one. Glumes opposite, subulate. The narrow glumes and central barren flower distinguish this from the nearly allied genus *Triticum*.

42. Triticum. —Spikelets solitary, parallel to the rachis, usually three- to many-flowered. Glumes opposite.

43. Brachypodium. —Spikelets many-flowered, solitary, subcylindrical, parallel to the rachis. Glumes unequal.

44. Lolium. —Spikelets many-flowered, compressed, at right angles to the rachis. Glume solitary, external; a small one occasionally present on the inner side of the spikelet.

35. Festuca *loliacea* much resembles *Lolium*.

* * * *Inflorescence paniculate. Panicle compact, or somewhat spicate.*

1. Anthoxanthum. —Spikelets one-flowered. Flower diandrous.

10. Gastridium. —Glumes ventricose at the base, not awned. Spikelets one-flowered.

11. Stipa. —Spikelets one-flowered, few, distant. Outer palea investing the ripe fruit, and terminating in a very long, twisted, knee-bent, feathery awn.

12. Polypogon. —Spikelets one-flowered. Glumes bifid at the apex, with long terminal awns.

17. Aira *præcox*. —For generic character see the following section.

26. Panicum. —Spikelets two-flowered; the lower imperfect, triandrous or neuter. Lower glume small.

28. Poa, some species.
29. Sclerochloa, some species.
35. Festuca, some species.

} See the following section.

* * * * *Inflorescence paniculate. Panicle lax.*

Spikelets one-flowered.

3. Leersia. —Spikelets without glumes.

5. Phalaris *arundinacea*.—Flower with one or two small hairy scales below the paleæ.

9. Milium. —Spikelets flat, or dorsally compressed. Glumes nearly equal.

13. Calamagrostis. —Spikelets laterally compressed. Flower surrounded by long hairs at the base.

14. Agrostis. —Spikelets laterally compressed. Flower naked or slightly hairy at the base. *Upper* glume smaller. *A. canina* has only a single palea to the flower.

15. Apera. —Like *Agrostis*, but with the *lower* glume smaller, and a *long* subterminal awn to the outer palea.

28. Melica *uniflora*.

Spikelets two- or more-flowered.

16. Catabrosa. —Glumes and paleæ broad, truncate, awnless.

17. Aira. —Glumes acute. Paleæ bifid; the lower one with a dorsal, twisted awn. Very near *Avena*, but with smaller two-flowered spikelets.

18. Corynephorus. —Like *Aira*, but the awn is clavate or thickened at the upper part.

19. Molinia. —Glumes acute, shorter than the flowers. Paleæ entire, awnless.

20. Melica. —Glumes equal to the flowers in length. Paleæ entire, awnless. A remarkable club-shaped appendage below the flowers, and within the glumes, represents a second or third flower.

21. Holcus. —Spikelets two-flowered. Upper flower stameniferous only, awned; lower one perfect, usually awnless.

22. Arrhenatherum.—Upper flower perfect, with a short awn; lower one stameniferous only, with a long twisted, knee-bent awn.

23. Hierochloe. —Middle flower perfect, usually diandrous; two lateral ones stameniferous only, triandrous.

28. Poa. —Spikelets awnless, ovate, mostly several-flowered. Glumes and paleæ more or less obtuse. Outer palea compressed, three- or five-veined.

29. Sclerochloa. —Flowers articulated with the rachis. Glumes shorter than the flowers. Outer palea five-veined, cylindrical below.

30. Glyceria. —Flowers articulated with the rachis. Spikelets linear or sub-cylindrical. Outer palea seven-veined.

31. Triodia. —Glumes nearly equal in length to the flowers. Outer palea three-toothed at the apex, rounded on the back.

32. Briza. —Spikelets much compressed, deltoid, or cordate. Glumes shorter than the flowers. Outer palea obtuse, boat-shaped.

33. Dactylis. —Spikelets in dense, round-topped clusters at the end of the branches of the panicle. Lower palea with a short awn.

35. Festuca. —Glumes and paleæ narrowing into a sharp point or terminal awn. Styles terminating the ovary.

36. Bromus. —Outer palea awned below the notched or bifid apex. Styles from below the summit of the ovary.

37. Avena. —Paleæ bifid, or with two points at the apex; lower one with a long knee-bent and twisted dorsal awn. *A. flavescens* much resembles *Aira*, but the spikelets are usually three- or more-flowered.

38. Phragmites. —Flowers awnless, with silky hairs at the base; lower one of each spikelet imperfect.

* * * * * Inflorescence of two or more unilateral spikes on the same culm.

47. Spartina. —Spikes two or three, erect. Spikelets single-flowered, in two rows. Style divided above. Stigmas elongated.

48. Cynodon. —Spikes spreading, digitate. Spikelets sessile, in a single row. Styles two. Stigmas short.

49. Digitaria. —Spikes spreading. Spikelets pedicellated in pairs. Styles two. Stigmas short.

The above definitions must not be regarded as having other than mere general application, but, conjoined to a careful comparison of specimens with the more extended generic characters as given in the text and corresponding figures, will be found useful.

Since the publication of the earlier numbers of this monograph, my remark, that *Anthoxanthum* is the only native grass the flowers of which are constantly *diandrous*, has been a subject of private comment on the part of some of our botanical subscribers, who consider it erroneous, directing especial attention to *Bromus diandrus* and *Hierochloe borealis*. In the first of these, a third stamen is, perhaps, more frequently present than the contrary; while the only wild specimen of the latter that ever came under my examination, had several of the central flowers of the spikelets, in this respect, corresponding to the lateral ones; and in garden examples the triandrous structure is almost as frequent as the diandrous. Such is not the case with the flowers of *Anthoxanthum*. The botanical student may learn from these facts not to over-value characters the permanence of which alone can confer upon them any real significance, a principle that it has been sought to illustrate, on the broad scale, throughout the volume now laid before him.

GLOSSARY OF BOTANICAL TERMS,

Occurring in the Descriptions of the Grasses.

Acuminate, narrowing to a point.
Anther, the tip of a stamen.
Apiculus, a short point springing from an abrupt termination.
Adpressed, } lying against any part
Appressed, } or organ.
Articulated, jointed with, and easily separating from.
Ascending, curving from the base upwards.
Awn, a stiff bristle-like process springing from a glume or palea.

Bifid, cut at the summit into two parts.
Bractea, a leaf or scale at the base of a flower.

Carinate, keel-like.
Caryopsis, the fruit of a grass.
Ciliated, fringed with hairs like the eyelids.
Clavate, club-shaped, thicker above than below.
Convolute, rolled inward from one margin.
Coriaceous, having a tough or leathery texture.
Culm, the straw or stem of a grass.
Cymbiform, boat-shaped

Decumbent, lying along the ground below, ascending at the extremity.
Deflexed, bent downwards.
Deltoid, triangular, or resembling the Greek *delta*.
Diandrous, two stamens in a flower.
Digitate, resembling fingers.
Distichous, in two rows, or arranged on two opposite sides.
Dorsal, attached to the back.

Erose, irregularly torn.

Filament, the thread-like part of a stamen bearing the anther.
Fusiform, spindle-shaped, narrowed at both extremities.

Gibbous, swollen.
Glaucous, sea-green, covered with a whitish powder or bloom.
Glume, the outer scales of a spikelet are so termed.

Hexandrous, six stamens in a flower.
Hispid, rough with hairs.

Imbricated, overlying like tiles on a roof.
Involucre, applied to two or more leaves or scales around the base of flowers.
Involute, rolled inward from opposite margins.

Ligule, a membranaceous expansion at the base of a grass leaf.

Monandrous, having only one stamen in a flower.
Mucro, a stiff point or short bristle from an abrupt termination.
Mucronate, bearing a mucro.

Ovary, the base of a pistil, becoming the fruit.

Palea, the inner scales or covering of a grass flower, of which there are usually two.
Panicle, applied to a loose and branched form of inflorescence, as in the Oat.
Papillose, having granular or pimple-like projections from the surface.
Patent, spreading more or less widely.
Pedicel, a stalk supporting a single flower.
Peduncle, a stalk supporting two or more flowers; its branches are pedicels.

Pistil, the central organ of a flower, the ovary or base of which becomes the fruit.

Racemose, a form of inflorescence resembling a bunch of currants or hare-bells.
Rachis, the part of a peduncle on which the flowers are borne.

Scarious, membranaceous, shrivelled, dry.
Scion, a young shoot, sometimes creeping, or spreading along the ground.
Serrated, having teeth like a saw.
Sessile, being without a stalk, literally sitting.
Seta, a bristle, or stiff hair.
Setaceous, bristle-like.
Spicate, having a compact form of flowering like an ear of corn.
Spike, an elongated inflorescence with sessile flowers.
Spikelet, one of the small clusters composing the inflorescence of a grass, usually included by the glumes; it may be one-, two-, or more-flowered.
Stamen, the male organ of a flower, consisting of filament and anther.
Stigma, the apex of a style, or when the latter is absent of the ovary; in the grasses the stigma is usually plumose or feather-like.
Stoloniferous, having *stolones*, or creeping shoots.
Style, a thread. or wire-like termination of the ovary, bearing the stigma.

Triandrous, three stamens in a flower, as in most of the grasses.
Truncate, terminating abruptly.

Umbel, an inflorescence in which several main flower-stalks spring from the same point.
Umbellate, arranged in an umbel.
Unisexual, flowers are so when bearing stamens only, or pistils only.

Verticillate, arranged in a circle, or radiating in all directions.
Viviparous, producing leaf buds that drop off and vegetate.

Whorl, where stalks, or other organs, are arranged like the spokes of a wheel.
Whorled, the same as verticillate.

GRASSES

OF

GREAT BRITAIN.

Genus 1. ANTHOXANTHUM. Vernal Grass.

GENERIC CHARACTER. Inflorescence more or less compact. Spikelets with two unequal glumes, three-flowered; the middle flower perfect, with two stamens and two small awnless paleæ; the two lateral ones rudimentary, each consisting of a single awned palea.

The three-flowered character of the spikelets in this genus is not very evident, as the scales, representing individually the two lateral flowers, would probably appear to the unscientific observer as outer appendages of the central one. The latter was, indeed, described by botanists of a comparatively late date as having a *double corolla*. The modern reading of the inflorescence is undoubtedly correct, but it is apt to mislead the uninitiated.

The genus is a small one, and only a single species is indigenous to the British Islands. The name, from the Greek *anthos*, a flower, and *xanthos*, yellow, was adopted in reference to the yellowish hue of the inflorescence compared with that of other European grasses.

ANTHOXANTHUM ODORATUM. Sweet-scented Vernal Grass. PLATE I.

Inflorescence spike-like, ovate-oblong, compound. Glumes longer than the awns.

Anthoxanthum odoratum, *Linnæus*. Generally adopted. *E. B.* 647.; ed. 2. 114.

A very common grass in meadows and pastures, whence, indeed, it is rarely absent, though chiefly abounding in those upon a moist rich soil. It is among the earliest of its tribe in flowering, and from this circumstance acquired the English name of Spring-Grass. The leaves are short, and so scantily produced as to contribute little to the general crop of hay. The flowering-stems, slender and wiry, vary much in their height according to situation, on open

pasture land not rising more than a few inches, while in meadows they attain a foot, and, under the shelter of woods, in which this grass is far from uncommon, sometimes two or three feet. The inflorescence is similarly diversified, from a short slender spike, about half the size of the smaller one on our Plate, to a form in which the stalks of the lower spikelets are so much lengthened as to render it conspicuously paniculate, a state represented in the larger figure. The structure of the flowers, upon which the generic character is founded, will be understood by reference to the magnified views; *a*, showing one of the spikelets with its two unequal glumes, the outer or lower one being the smaller, while the two stamens and two stigmas of the middle fertile flower appear between them; at *b*, are the two short paleæ of this flower, seen as separated from between the two awned scales representing the lateral abortive ones at *c*: the objects of both these latter figures are supposed to be included within the glumes of the spikelet at *a*. The Sweet-scented Vernal Grass is the only British species in which the flowers have constantly two stamens in each, the fertile or seed-bearing ones of all the others being *triandrous*, i. e. having three.

Bruised by walking over it, or rubbed between the hands, especially during the flowering season, this grass diffuses an odour somewhat resembling that of Gum Benzoin, and has long been regarded as the source of the peculiar scent of new-mown hay: other indigenous species yield, however, a similar, though less powerful perfume, dependent upon a volatile essential oil, and therefore readily dissipated by the process of drying. Boccone, as quoted by Withering, mentions that, in his time, a distilled water was prepared from the Anthoxanthum as a vehicle for some perfumes.

Some of the earlier writers upon the relative qualities of British grasses as fodder, seem to regard that before us as a valuable and important one to the farmer. Stillingfleet observes, that, "being found on such kinds of pastures as sheep are fond of, and from whence excellent mutton comes, it is most likely to be a good grass for sheep pastures," and recommends the collection of its seeds, which he assures us, from his own experience, are "very easy to gather:" and I have, somewhere else, met with a proposition for sowing it on those sheep downs where it does not exist, in order to improve the flavour of the mutton. In opposition to such practice, I have myself observed that on some of those of Kent and Sussex, its leaves are, almost constantly, left untouched by the sheep, or only cropped when, in dry seasons, food becomes scarce. In the experiments made by Linnæus and his colleagues, it appears that cows, horses, goats and sheep ate it when offered to them apart; but these experiments were too limited, and too carelessly conducted to warrant the importance attached to them at the time; and, as far as the last-mentioned animals are concerned, Stillingfleet's

mutton must have owed its "excellence" to other sources. They seem, however, to have had considerable influence on the opinions of the earlier agricultural systematizers of this country, and the Sweet-scented Vernal Grass always holds a place among the species recommended by them for the production of improved meadow-land. The scantiness of the foliage is very much against its value as an economical grass, it yields little to the scythe, while in permanent pastures it occupies the place of others more nutritious and better liked by cattle generally. Whether its wide distribution among the latter, in almost all soils and situations, may not be productive of some wholesome medicinal effect, on the more promiscuously feeding grazing animals, is a question perhaps deserving consideration; the more so, that certain tropical grasses, celebrated on account of their fragrance, have long been employed in their respective countries with a view to the benefit derived from their tonic, stomachic, and other qualities.

Flowers from the beginning of May to July. Perennial.

Genus 2. NARDUS. Mat-Grass.

GEN. CHAR. Spikelets forming two rows on one side of the common stalk or rachis, in the hollows of which they are sessile; without glumes, 1-flowered. Paleæ two, the outer one longer. Style and stigma solitary, the latter filiform.

The single British species of this small genus is at once distinguishable from the rest of our indigenous grasses by its solitary style and stigma, as *Anthoxanthum* is by its two stamens. Neither the botanical nor the English name is at all applicable to the qualities or uses of the rigid, wiry, slender and scentless plants of which it is constituted; the Greek word *nardos*, especially, being applied to an odoriferous shrub, is very inappropriate to a grass destitute of odour.

NARDUS STRICTA. Small Matweed. Mat-grass. PLATE II.

Stems and leaves erect, very slender, rigid. Spike compact. Outer palea twice the length of the inner.

Nardus stricta, *Linnæus*. *E. B.* 290; ed. 2. 75. Generally adopted.

Generally abundant on moors and heaths throughout the kingdom, likewise on sandy pastures in places where moisture collects during the winter. Each plant forms a dense tuft, consisting of nearly erect, very slender, smooth, bristle-like leaves. The flowering stems vary from four to eight inches in height, each with a single node or joint near the base from which a leaf pro-

ceeds, and terminating in a slender one-sided spike of inflorescence, the rachis of which is grooved at intervals on one side, bearing the single-flowered spikelets in a double alternate series. One of these spikelets is shown, much enlarged, in figure *a.* on our Plate. The lower or outer palea is lanceolate, terminating in a rough awn or point, is of a rigid texture and purplish-green hue; the inner one, lying at first within the groove of the rachis, is short and membranaceous. Figure *b.* exhibits the pistil with its erect style and solitary stigma, so different from that of the grasses in general.

This little grass is so rigid that cattle seldom touch it. Its value in nature seems chiefly that attaching to a vegetable pioneer, as it quickly disappears under the efforts of cultivation, and is rarely an occupant of any other than the poorest soil. The rigid tufts are often to be met with forming part of the nest of the Rook and other rough building birds.

It flowers in June and July. Perennial.

Genus 3. LEERSIA.

GEN. CHAR. Inflorescence paniculate. Spikelets one-flowered; without glumes. Paleæ two, carinate, laterally compressed, awnless, nearly equal in length, the outer one broader, cymbiform. Stamens 3–6. Stigmas plumose. Fruit free, but enclosed by the dry paleæ.

The plants of this genus, of which not more than three or four are recognized at present, are nearly allied in structure to *Oryza*, the Rice, and *Leersia oryzoides* is the only representative of the family of grasses named after it, *Oryzeæ*, which is indigenous to Europe. *Leersia lenticularis*, a North American species, growing in wet gravelly woods in the southern States of the Union, was observed by Pursh, who found it on the islands of Roanoak river in North Carolina, "catching flies in the same manner as *Dionæa muscipula*," by the irritability of its paleæ, which he compares to the leaves of that singular plant. The generic name was bestowed by Dr. Solander, in commemoration of J. D. Leers, a German botanist.

LEERSIA ORYZOIDES. Rice Grass. PLATE III.

Panicle spreading, with wavy branches. Flowers semi-elliptical, triandrous; the paleæ ciliated. Leaves rough: ligule short.

Leersia oryzoides, *Swartz. Borrer, E. B. Supp.* 2908. *Babington, &c.* Phalaris oryzoides, *Linnæus.* Ehrhartia clandestina, *Weber.* Asprella oryzoides, and Homalocenchrus oryzoides, of others.

First noticed as a native of Britain in September 1844, by Mr. W. Borrer, by whom it was discovered at Henfield, Sussex, "where it grows in several places within the edges of marsh-ditches in the Level, the open marshes drained by the river Adur:" since met with in similar situations in Surrey and Hampshire. Stems forming tufts, about two feet high, smooth, except at the joints, which are clothed with short deflexed hairs: though generally erect, they have a tendency to become decumbent and root at the lower part, and numerous horizontal suckers, extending from the base of the tuft, render it easy of propagation. Leaves spreading, broad, flat, strongly veined, rough, especially on the margins, yellowish-green, slightly glaucous. Ligule short, abrupt. Panicle, when developed, lax; its rachis and spreading branches more or less zigzag, waved or curled, slender, rough. Flowers compressed, solitary, without glumes; paleæ carinate; the outer one broad, with five green veins, those of the keel and margins especially ciliated with strong bristles; the inner palea linear, less deeply veined, and with its margins diaphanous and inflexed. Stigmas plumose, with branched hairs. Fruit enclosed within the persistent dried paleæ, but not cohering with them. The flowers are often imperfect.

Indigenous to a warmer and continental climate, this grass rarely, if ever, protrudes its inflorescence in England: it may, however, be found about the end of August enclosed within the inflated sheath of the uppermost leaf, and occasionally even with a few flowers pushing forth, to fall off probably without maturing. Our figure represents a more advanced state, and, with the magnified views of the floral structure, will furnish the home botanist with the aspect and features which a more congenial residence would elicit in the grass before us.

The species is widely distributed over the temperate and warmer countries of the northern hemisphere, on both sides of the Atlantic, but must be regarded as an alien in the flora of our island, where the mean temperature of the summer seems too low to admit of the maturation of its seeds.

Genus 4. ALOPECURUS. Fox-tail Grass.

GEN. CHAR. Inflorescence compact, spike-like. Spikelets laterally compressed, with two nearly equal glumes generally united at the base, one-flowered. Flower with a single palea, which is five-veined and awned from the base. Stigmas filiform.

The grasses of this genus may be generally recognized by their elongated, hairy inflorescence, which is soft to the touch; but they correspond, in aspect, too nearly with those of the genus *Phleum* to be determined without reference to the generic character. The

resemblance, on comparison, will be found merely superficial, but is likely to mislead an inexperienced observer. The flowers of *Phleum* have two paleæ, which are destitute of awn, the hairy appearance of the spike being due to the bristly points of the glumes; hence indeed it is, in most instances, rougher to the touch than that of the Fox-tail grasses.

The name is from the Greek *alopex*, a fox, and *oura*, a tail, in allusion to the form of the inflorescence.

ALOPECURUS PRATENSIS. Meadow Fox-tail Grass. PLATE IV.

Stem erect, smooth. Inflorescence spicate, ovate-elongate, subcylindrical. Glumes hairy, lanceolate, acute, connected below. Awn twice the length of the palea, arising from its base.

Alopecurus pratensis, *Linnæus*. *E. B.* 759; ed. 2. 85. Generally adopted.

One of the most common of our meadow grasses. Its strong fibrous roots take a firm hold of the soil, but the plants have little or no tendency to extend themselves laterally by creeping. The flowering stems vary in height, according to the character of the soil, from one to three feet; having the sheath of the uppermost leaf usually much inflated. The ligule is very short and obtuse. The spike, or spicate panicle, is of a light or yellowish-green colour, with a tinge of grey owing to the silvery hue of the long awns; it varies in length from one to three inches. Anthers yellow. In the magnified views of the flower, *a* represents the two compressed ciliated glumes, united at the base; *b*, the solitary flower, with its single palea and long awn; *c*, the pistil, with its filiform stigmas and elongated style.

This is almost universally regarded as one of the most valuable of our indigenous grasses, "possessing," as observed by Martyn, "the three great requisites of quantity, quality, and earliness in a superior degree to any other." In regard to quantity, it has been affirmed to yield more bulk and weight of hay than any other grass hitherto subjected to experiment; and, as the first crop may be cut early, or about the middle of May, the latter math is unusually productive, exceeding in value, according to Sinclair, the crop at the time of flowering, in the proportion of 24 to 13. These remarks, however, are only applicable to it in favourable situations, as, at Woburn, the produce was nearly three-fourths greater from a clayey loam than from a sandy soil, and the grass from the latter was of comparatively less value in the proportion of 4 to 6. A moderately stiff and moist soil seems necessary to elicit the qualities that render the Meadow Fox-tail valuable; in a poor and dry one it becomes almost useless.

Perennial. Flowers from April to June. The seed ripens in June and July, but remains long after within the husk: it appears peculiarly liable to the attacks of certain insects, a circumstance unfavourable to its collection where any large quantity is required.

ALOPECURUS ALPINUS. Alpine Fox-tail Grass. PLATE V.

Stem erect, smooth. Inflorescence spicate, ovate or oblong. Glumes ovate, abruptly pointed, downy, connected at the base. Awn longer than the palea, arising from its middle.

Alopecurus alpinus, *Smith. E. B.* 1126; ed. 2. 86. Generally adopted.

Only admitted into the European flora as a native of Scotland, where it is found at an elevation of between 2500 and 3500 feet. It is recorded as being plentiful in North America and Spitzbergen, but in its British habitats, about Loch-na-gaar, in Aberdeenshire, Ben Lawers, and the Clova district, it may be regarded as among our botanical rarities. Rooting in hollows and the crevices of rocks about rills and waterfalls, it sends out occasionally a few lateral creeping shoots, that root as they extend. The flowering stems are at first decumbent, but assume an erect position beyond the first or second joint, rising to the height of six inches or a foot. Notwithstanding the difference in the form of the glumes and in the attachment of the awn, there is a very close resemblance between this grass and some stunted specimens of *A. pratensis*, which it approximates in the inflated appearance of the uppermost leaf-sheath, the usually shorter and broader form of the leaf itself, and the obtuseness of the ligule. The assumed differential characters upon which the species is founded, may be traced by comparison of the magnified figures of the flowers of the present with those of the preceding, Plate IV., the initial letters of the two corresponding.

Perennial. Flowers in July and August.

ALOPECURUS AGRESTIS. Slender Fox-tail Grass. PLATE VI.

Stem erect, scabrous. Inflorescence spicate, cylindrical, tapering, slender. Glumes lanceolate, acute, united half-way, nearly smooth. Awn twice the length of the palea, arising from a little above the base.

Alopecurus agrestis, *Linnæus. E. B.* 848; ed. 2. 87. Generally adopted.

This grass, known in many parts of the country by the name of Black Bent, is of frequent occurrence on road-sides and waste

ground, as well as in corn-fields, where, indeed, it is one of the most troublesome weeds. In pastures it rarely intrudes, unless in a poor and dry soil, and cattle generally leave it untouched. Stems slender, from a foot to a foot and a half in height. Leaf-sheaths rough. Ligule obtuse. Spike from two to four inches long, slender and acuminated, frequently of a purplish hue. The compressed glumes, connected nearly half their length, are smooth except on the keel or mid-vein, which is ciliated with short hairs. The awn is occasionally three times the length of the palea. The references to the magnified views of the flowers accord with those of *A. pratensis*.

Annual. Flowers from May to October.

ALOPECURUS BULBOSUS. Tuberous Fox-tail Grass. PLATE VII.

Stem decumbent at the lower part, smooth. Inflorescence spicate, cylindrical, acuminate. Glumes linear, abruptly pointed, downy, separate, much longer than the palea. Awn arising above the base of the palea, about twice as long.

Alopecurus bulbosus, *Linnæus*. *E. B.* 1249; ed. 2. 88. Generally adopted by modern botanists. A. geniculatus bulbosus ?, *Hudson*.

This species is rare, and apparently confined to the southern parts of our island, where it has hitherto been found only in a few localities. Salt or brackish marshes, near the sea or the estuaries of tidal rivers, are its natural habitats, as near Yarmouth, Weymouth, and in Cardiff marshes, Wales; Hudson mentions having found it near Northfleet, Kent; and, in June 1840, I met with several plants of it in a meadow on the Thames side, a little above Erith. Shoots tufted, not creeping, the lowermost joints thickening into bulb-like tubers. Stems six inches to a foot in length, nearly erect above, but bent in a kneed manner at the first or second joint from the ground. Upper leaf-sheaths inflated. Ligule oblong. Spike an inch to an inch and a half long, dark, rather glaucous-green: the very short pedicels, which in other species of the genus render the apparent spike truly a raceme, in this instance often bear a second, but always abortive flower. The complete separation of the glumes is shown at figure *a*; the form of the palea *in situ* and insertion of the awn at *b*; but the former, when spread out, terminates abruptly with a notch at the extremity and two minute teeth. Anthers blue or purple.

Perennial. Flowers in June and July.

The earlier English botanists seem to have doubted the distinctness of this from the next species, and comparison renders their scepticism far from being unfounded; our modern fellow-students

are disinclined to part with a species, especially a rare one, and artist and author have here done their best to uphold its claim, which, however, the latter regards, at best, equivocal.

ALOPECURUS GENICULATUS. Floating Fox-tail Grass. PLATE VIII.

Stem ascending, bent at the joints, smooth. Inflorescence spicate, cylindrical, obtuse. Glumes united at the base, obtuse, downy, ciliated, rather longer than the palea. Awn from near the base of the palea, and twice as long. Anthers linear.

Alopecurus geniculatus, *Linnæus*. *E. B.* 1250; ed. 2. 89. Generally adopted.

A common species in watery situations, by the sides of ditches and ponds, the surfaces of which are often covered by its branched floating stems: occasionally it is met with in dry places, or rather on ground which, though dry during the summer, is liable to become marshy or even overflowed in wet seasons; more rarely, specimens of stunted growth occur on old walls and in other unlikely habitats, in which case the bases of the stems assume the bulb-like character of those of *A. bulbosus*. Stems about a foot or eighteen inches long, branching below, decumbent when not floating, the flowering extremity only erect; more or less sharply bent at the joints, and especially at the uppermost, whence the specific name, and its occasional English one of Kneed Water-Grass. Leaves variable in length, the sheath of the upper one inflated, as in the species of this genus generally. Ligule oblong. Spike one to two inches long, not attenuated above. Glumes united at the base, but often so slightly as to appear, at first sight, separate. Palea oblong, obtuse, slightly notched at the extremity, its awn arising from above the base and extending to twice its length. Anthers purple or violet, changing to dull yellow or rust-colour.

Perennial. Flowers from June to August.

A. geniculatus is a plant of variable character, as is frequently the case with others of aquatic habit; and, whether the preceding, *A. bulbosus*, be a distinct species or not, there is certainly a tendency in this to assume one of its most striking peculiarities, the thickening of the lower nodes of the stem. Most of the grazing animals devour this grass with avidity.

ALOPECURUS FULVUS. Orange-spiked Water Fox-tail Grass. PLATE IX.

Stem ascending, bent at the joints, smooth. Inflorescence spicate, cylindrical, tapering above. Glumes united at the base, obtuse, downy, ciliated, not longer than the palea. Awn from the

lower part of the palea, scarcely exceeding it in length. Anthers short, broad.

Alopecurus fulvus, *Smith.* *E. B.* 1467; ed. 2. 89*; and of most modern botanists. A. geniculatus, *Host, Gram. Aust.* v. 2. tab. 32. *Hooker, Fl. Scot.* 1. p. 22.

Less common than *A. geniculatus,* but far from unfrequent on the sides of ponds and ditches, and sometimes growing in the water from the bottom. It is a more luxuriant plant, with broader foliage and larger flower-spikes, though so much resembling the last species in structure as almost to justify belief in their identity. Although Dr. Withering and other earlier English writers suspected it might prove distinct from the species under which they placed it, Sir J. E. Smith was the first to bestow upon it name and place as such, and that with some hesitation. Stems one to two feet or more in length, decumbent at the lower part, branched and knee-bent at the joints, usually sheathed by leaves to the base of the inflorescence. Ligule oblong. Spike cylindrical, usually tapering at the upper part, two or three inches long, pale green. Glumes connected at the base, about the length of the palea or scarcely equal to it. Palea oblong, obtuse. Awn fine and very short. Anthers peculiarly short, or nearly equal in length and breadth; when ripe deep orange colour, rendering the plant very conspicuous at a considerable distance when in flower. Styles generally separate to the base.

Perennial. Flowers from July to September.

The initial letters appended to the magnified figures of the flowers, corresponding throughout, will, as in the instance above cited between *A. pratensis* and *A. alpinus,* enable the reader to contrast the structural differences of the three species last described. Of the value attaching to some of the features assumed as characteristic there may be some question, without involving the necessity of discarding them altogether. Thus the complete distinctness of the glumes in *A. bulbosus,* and their, frequently very equivocal, union at the base in *A. geniculatus* and *A. fulvus,* are characters which must be lightly estimated by the student of vegetable morphology, as are likewise those derived from the union or separation of the styles remarked upon by some botanists: but, however liable to vary, their preponderance must be the result of organic or physiological action, an action, which though liable to be influenced by accident, may originate in a more profound and less unstable source; hence the difficulty in determining between species and varieties.

Genus 5. PHALARIS. Canary Grass.

GEN. CHAR. Inflorescence either compact and spike-like, or loosely panicled. Spikelets laterally compressed, with two equal, carinated glumes enveloping a single perfect flower and one or two rudimentary ones. Flower with two unequal coriaceous paleæ. Styles long. Stigmas filiform. Fruit invested by the hardened paleæ.

The exotic species of this genus are numerous, and belong generally to warmer climates than our own. Of the two species, enumerated in the British Flora, one only can be regarded as indigenous; and they differ so greatly in aspect, that an ordinary observer would scarcely recognize them as near associates, and, at the same time, experience a similar difficulty in detecting the rudimentary flowers contained in the spikelets. These flowers are only represented, in most instances, by two small scales or bracts at the base of the paleæ of the fertile one, as exhibited in the magnified figure *b* on Plate X.

The derivation of the generic name, an ancient one, is doubtful, but it has been suggested to have been formed from the Greek *phalos*, brilliant, in allusion to the glossy seeds of some species.

PHALARIS CANARIENSIS. Cultivated Canary Grass. PLATE X.

Inflorescence ovate, compact, spicate. Glumes boat-shaped, the keel extending into a broad, entire wing. Rudimentary flowers two, half as long as the fertile one. Paleæ hairy, ciliated.

Phalaris canariensis, *Linnæus*. *E. B.* 1310; ed. 2. 76. Generally adopted.

Though long since introduced as a British grass, this species can scarcely be considered as naturalized, rarely or never being met with two successive seasons in the same habitat, unless where it is cultivated in the neighbourhood. Stems erect, one to two feet high, glaucous. Leaves broad; the sheath of the uppermost one inflated. Spicate inflorescence broadly ovate. Glumes large, pale yellow-green, marked with deeper green lines; conspicuously winged on the back; much longer than the spikelet they enclose. Of the enlarged figures, *a* represents one of the laterally compressed spikelets, with its two dorsally winged, boat-shaped glumes opened to exhibit the single perfect flower; *b* shows the paleæ of this flower expanded, with the two scales below them which are regarded as abortive flowers; *c* is the perfect flower, less magnified and without the latter appendages.

This grass, first brought from the Canary Islands, is cultivated

for the production of the so-called Canary-seed, used for feeding caged singing-birds: the demand for this purpose being limited, the crops raised are only local, and were for a long period almost exclusively confined to the Isle of Thanet. Horses are fond of the chaff, and it is esteemed wholesome food for them; but, with this exception, the value of the seed is the only source of remuneration to the farmer, the produce in straw being nearly worthless. It requires a rich soil, well manured, and not too retentive of moisture. The seed is sown in February, in drills about eight inches apart, and the plants are eventually thinned out to two or three inches distance in the rows, a necessary provision for the after use of the hoe to keep them clear of weeds, the growth of which is more rapid than their own. As the seed ripens, it is more liable to the depredations of small birds than any other kind of grain, a circumstance that renders an open country, like that of Thanet and the adjoining parts of Kent, with few trees and hedge-rows to shelter them, essential to the success of the crop. The produce is from thirty to forty bushels per acre, but the crop is precarious. In the green state this grass seems peculiarly grateful to cattle, but it yields too little food on the same space of ground to compete with those in ordinary use.

Annual. Flowers in July.

PHALARIS ARUNDINACEA. Reed Canary Grass. PLATE XI.

Panicle erect, with spreading branches. Spikelets clustered, leaning in one direction. Imperfect flowers one or two hairy scales at the base of the paleæ.

Phalaris arundinacea, *Linnæus. E. B.* 402; ed. 2. 77. Calamagrostis variegata, *Withering.* Arundo colorata, *Aiton, Hortus Kewensis,* ed. 2. Digraphis arundinacea, *Lindley.*

A common plant on the borders of rivers, pools, and ditches. It creeps widely at the root, but, unlike many grasses of similar habit, tends to form dense tufts, which contribute greatly to the consolidation and support of the banks on which it grows. The flowering stems, erect, smooth, and comparatively slender, vary in height from two to five feet; terminating in a beautiful, variously branched panicle five to eight inches long, the spikelets of which are clustered at the extremities of the branchlets and lean in one direction. Leaves half an inch or more in breadth. Flowers varying in hue in different situations from almost white to pale green in the shade, and under exposure to the sun to rich shades of purple and yellow, with large red anthers; whence the specific names, *variegata* and *colorata,* above quoted. The floral structure will be understood by reference to the magnified views, of which, *a* represents the glumes,

not winged on the back like those of *P. canariensis*; *b*, the single fertile flower, removed from between the latter, with the two ciliated or hairy scales at the base of its paleæ, indicating the rudiments of two others; *c* is the pistil. The rudimentary flowers are not universally present, often only one will be found, and not unfrequently they are both absent.

The variegated grass so frequent in gardens, and known by the names Ribbon Grass, Painted Lady Grass, and Lady's-traces, is a variety of this, occasionally, but very seldom, met with in the wild state.

The Reed Canary Grass is one of nature's pioneers, and though exceedingly valuable in habitats of its own selection, is of small economical importance elsewhere. The creeping shoots are probably nutritious; they have a sweetish flavour, and pigs will often devour them with avidity, as I have noticed especially with those of the garden variety; but the herbage is too coarse and rigid to be liked by cattle generally. According to Linnæus, however, it is used as fodder for them in Sweden, and in the province of Scania mown twice a year for that purpose. The peasantry in that country employ it as thatch for their cottages and ricks, and find it more durable than straw.

There is so much difference in habit and general aspect, between this species and the foregoing, that their relationship would scarcely be suspected by the ordinary observer. The structure of the spikelets is, indeed, the only circumstance which warrants their association in the same genus; the rules of botanical classification, however useful and necessary to the advancement of their science, being in this instance very arbitrarily exercised.

Perennial. Flowers in July and August.

The species is very widely distributed on river-sides in the northern parts of both the eastern and western continents.

PHALARIS PARADOXA. Bristle-spiked Canary Grass.

Inflorescence spicate, cylindrical. Glumes of the fertile flower with a blunt toothed keel, many-veined. Rudimentary flowers several, short, abrupt.

Phalaris paradoxa, *Willdenow. Babington, Man. Brit. Bot.* ed. 4. 390.

This species, a native of the south-eastern parts of Europe and Asia Minor, has been met with in the vicinity of Swanage, Dorsetshire, but has even less claim to be considered one of the grasses of Great Britain than its ally *P. canariensis*. "Stem decumbent at the base, one to three feet high, branched. Lower part of panicle usually barren; branches with about six spikes."

"Annual. Flowers in July."—*Babington.*

Not having obtained an English specimen, we have not a figure of this grass, being compelled at present to postpone it, as well as further description, to a probable supplementary number of our work.

Genus 6. AMMOPHILA. Sea Reed.

GEN. CHAR. Inflorescence compact, spike-like. Spikelets with two nearly equal keeled glumes, one-flowered. Flower with silky hairs at the base; paleæ two, the lower one shorter, with a very short awn.

The name, from the Greek *ammos*, sand, and *philos*, a lover, refers to the habitat of the following species, the loose and shifting sands of the sea-shore. The original of *ammos* being *psammos*, and the term *Ammophila* having been bestowed upon a genus of Hymenopterous insects, prior to its adoption by the botanist, the genus before us is by some modern writers altered to *Psamma*.

AMMOPHILA ARUNDINACEA. Sea Reed. Helme. Matweed. Marram. PLATE XII.

Inflorescence spicate, fusiform. Glumes and paleæ acute. Basal hairs one-third the length of the paleæ.

Arundo arenaria, *Linnæus*. *E. B.* 520; ed. 2. 78. Calamagrostis arenaria, *Withering*. Ammophila arenaria, *Lindley*. Ammophila arundinacea, *Hooker*. Psamma arenaria, *Beauvais, Babington, &c.*

Frequent upon the dry and loose sand by the sea-shore, among which its creeping stems, rooting from every joint, rapidly extend themselves to an indefinite length, crossing each other in every direction; and thus forming a coarse network that prevents the sand from being readily washed away, or driven inland by the action of the wind. Flowering stems erect, two or three feet high, very rigid. Leaves rigid, glaucous, very long and narrow, with the edges rolled inwards or involute, pointed and almost thorn-like at the extremity. Inflorescence spicate, fusiform, or becoming acuminated both above and below, rather than cylindrical, from three to six inches long and three-quarters of an inch broad about the middle, yellow or straw-coloured, with red anthers. Glumes longer than the paleæ; the larger one of both having, usually, a small indentation below the acute point.

Perennial. Flowers in July.

Herbivorous animals seem universally to reject this grass, its extreme rigidity, and the almost total absence of nutritive matter,

rendering it neither palatable nor wholesome. Admitting this, however, its economical value is of no trifling amount, as thousands of acres of fertile land, adjoining the low sandy parts of our coasts, must within a few years be reduced to almost hopeless sterility were it to be removed. To form any adequate idea of the distressing effects produced upon cultivation by the drifting of sea-sand, we must visit districts liable to its inroads, and notice, during the prevalence of high winds, the manner in which it is borne by their resistless force inland. On one part of the coast of Norfolk, especially, the sand-flood is recorded as having advanced five miles over the land of the interior, once fertile and productive during the past century; but its influx is often far more rapid and fearful. A district of more than ten miles square on the western coast of Scotland, near the town of Forres, which on account of its fertility was termed the granary of Moray, was completely inundated by it in the course of a few years, so that not a vestige was to be seen of the manor-house, orchards, and offices of the barony of Coubine to which it belonged. The advance of the sand-flood, in this instance, is said to have been so great, in the year 1769, that an apple-tree was buried by it during that winter, only the very top of it appearing above the surface. This calamity was occasioned by some persons thoughtlessly pulling up the Mat-grass that had previously bound the surface of some sand-hills in the neighbourhood. It is not only by restraining the inland drift of the dry sand, that the importance of this innutritious, but otherwise valuable species of grass is manifested. The banks and dunes on which it vegetates are equally protected from being swept down by the sea which raised them, a catastrophe to which they are liable during high tides and in stormy weather; and it is to their early acquaintance with its efficacy in this respect, that the Hollanders and other maritime peoples are indebted for the preservation of no inconsiderable portion of territory. We are not without many examples of a similar kind in our own island, and among these we may refer to the sea-port of Hull, in Yorkshire, which would long since have been covered by the waters, were it not protected by the ridge of sand called Spurnpoint breaking the force of the waves before they reach the town; the point itself owing its stability against the tempestuous action of the German Ocean to the Mat-grass by which it is overgrown.

The strength and toughness of the creeping stems render them valuable to the lower classes inhabiting some parts of the coast, who manufacture them into ropes and mats, and Withering observes that those of Newborough, in Anglesea, derived their chief subsistence from such employment. The land proprietor, the farmer, and others interested in the soil, ought, however, to watch its appropriation to such or any other purpose with a jealous eye; its

extermination, or even its partial removal, being attended with so much danger to the neighbouring country; over which the sand, once unbound, spreads with a pace scarcely to be interrupted by any means but those which nature herself employs for the purpose, a circumstance that cannot be too earnestly commended to their notice. An act was passed in the reign of Elizabeth, and renewed in that of George II., prohibiting persons from pulling up or otherwise destroying it.

As the sand becomes settled, and fertilized by the annual growth and decay of this and various other plants which then successively vegetate upon it, the *Ammophila* gradually yields place to grasses of different character; migrating, by pushing its underground stems, constantly, toward the looser and more recently deposited sand which it is necessary to fix in its turn. On the sandy shores of the estuary of the Conwy, and near the mouth of the Mersey, on the Cheshire coast, I have several times traced these running stems to the length of twenty or thirty yards, without arriving at their termination.

Genus 7. PHLEUM. Cat's-tail Grass.

Gen. Char. Inflorescence dense, spike-like. Spikelets laterally compressed, one-flowered. Glumes two, nearly equal, compressed, keeled, truncate with a terminal bristle point, or acuminate; longer than the paleæ. Paleæ two, membranaceous; the lower one three-veined.

The grasses of this genus so much resemble in general aspect those of our fourth, *Alopecurus*, as to be readily mistaken without a careful examination of the inflorescence; see remarks on the generic character of the latter, page 5. The species, with one or two uncertain exceptions, are of small agricultural value, being disliked by cattle, and either of rare or very local distribution in the British Islands.

In several of the species a minute subulate (awl-shaped) scale, accompanying the single perfect flower contained within each pair of glumes, indicates the presence of a second in a rudimentary state.

The name is from the Greek *phleos*, formerly applied to some aquatic grass or grass-like plant, and adopted by Linnæus as that of the genus before us probably without any reference to its original signification.

Phleum pratense. Meadow or Common Cat's-tail Grass. Timothy Grass. Plate XIII.

Inflorescence spicate, cylindrical, very long. Glumes oblong,

truncate, terminating in an awn or mucro less than half their length: ciliated on the keel. No rudimentary flower.

Phleum pratense, *Linnæus*. *E. B.* 1076; ed. 2. 79. Generally adopted.

Very frequent in meadows and pastures, where, unless in very dry soils, it has a tendency to creep at the root and interfere with the growth of others among which it vegetates. The flowering stems are rigid, erect from a little above the base, and vary from a foot to eighteen inches or more in height, terminating in a long cylindrical, densely spicate inflorescence, three to seven inches in length. The glumes, very much compressed, are membranaceous towards the margin, but with a strongly marked green line along the keel, which is ciliated with fine hairs that render the spike very soft to the touch: their general outline terminates very abruptly, but an extension of the keel vein in the form of a bristle gives them the appearance of having a terminal awn. *a*, represents the foregoing character of the glumes; *b*, the solitary flower, removed from between them; *c*, the pistil.

Soil and situation affect the habit of this grass so greatly that accidental varieties have been occasionally regarded as distinct species. On barren pastures and road-sides it is often decumbent, and the flower-spikes less than an inch in length. In some instances, the lowermost joints of the stems become swollen in the form of tubers, constituting the *Phleum nodosum* of Linnæus and later botanists; a variety of not unfrequent occurrence in the dry elevated sheep pastures of Wales and other hilly or mountainous districts. In moist rich soil, both of these lose their peculiarities and assume the normal character of the species to which they appertain.

Much difference of opinion seems at all times to have prevailed, among our scientific agriculturists, in regard to the value of this grass, and the question is far from being decided at present. Attention was first directed to it in this country, owing to the circumstance of its having been brought over from New York or Carolina as a novelty, towards the close of the last century, by Timothy Hanson, whence, indeed, the name by which it is most generally known among our farmers. The praises bestowed upon it by some writers and experimenters, and the neglect and even condemnation it has received from others, are results of the varied circumstances under which their experience was obtained, and ought to be appreciated with caution. That it is not a grass suited naturally to the climate of Great Britain appears, it has been remarked, from its not being generally found in the best natural pastures; a fact by no means substantiated by my own observation, as there are few such pastures upon which it does not exist, though in exceed-

ingly varied condition, and, probably, equally varied as to nutritive quality. Hence may have originated the diversity of opinion remarked upon above, a summary of which is rather amusing than satisfactory. Allowing priority in quotation to the earlier writers, Dr. Pulteney remarked, that, notwithstanding the character which this grass acquired from La Roque's recommendation, sheep dislike it, neither are cows nor horses fond of it. Leers, on the contrary, informs us that it affords an excellent pasture for horses. Swayne calls it, a hard, coarse grass, of little value for cattle. Dr. Walker thought it might be introduced into the Highlands of Scotland with good effect. At Woburn, its comparative merits were considered very great; owing to its producing abundance of fine foliage early in the spring, which, as it flowers late, may be cropped until an advanced period of the season without injury to the crop of hay. One writer states that the value of the grass as hay when the seed is ripe, is to that when it is in flower as 10 to 23; another, that when the seed is ripe the stem contains more nutritive matter than that of any other grass which is cut for hay. Its value and capabilities may perhaps be more correctly appreciated from the following facts. On a moderately rich and tenacious soil, the *Phleum pratense* is a durable and nutritive grass, though too coarse to be generally liked by cattle, unless in the spring, when the early and abundant foliage is often remarkable, in those pastures in which it is plentifully distributed, among the scanty verdure of the later grasses. Where quantity rather than quality is an object in making hay, the Timothy Grass is fully equal, if not indeed superior, in yield to the Meadow Foxtail; but the hay is harsh and wiry. All of its better qualities are dependent on the depth and retentive character of the soil; where that is light and shallow, as over chalk and gravel, it either becomes useless or soon disappears.

Perennial, or, according to some botanists, biennial. Flowers in June and July.

PHLEUM ALPINUM. Alpine Cat's-tail Grass. PLATE XIV.

Inflorescence spicate, ovate-oblong. Glumes oblong, truncate, terminating in an awn or mucro equalling them in length: ciliated on the keel.

Phleum alpinum, *Linnæus. E. B.* 519; ed. 2. 80. Generally adopted.

This is one of our rarest British grasses, being only met with on wet alpine moors of from two to four thousand feet elevation: the Breadalbane mountains, and one or two other districts in Scotland, are its only recorded native habitats. The above specific character,

depending upon the shape of the flower-spike and the comparative length of the glume-awn or bristle, is not so decisive of the difference between this and the smaller varieties of *P. pratense* as might be desirable, though its distinction as a species cannot be doubted. Short-spiked specimens of the latter species, however, do not present the broad oval outline distinguishing the inflorescence of the present, which is generally of a much darker colour and with a purplish tinge. It has the same tendency to creep and root at the base as its congener, and the flower-stems vary from six inches to a foot high.

Perennial. Flowers in July.

Mr. Babington remarks that our plant is the *P. commutatum*, and differs from the true *P. alpinum* by its shorter panicle (inflorescence), not ciliate awn, much inflated upper leaf-sheath, and short blunt ligule."

P. alpinum is said to constitute the principal part of the turf in the most elevated pastures of Switzerland.

PHLEUM ASPERUM. Rough Cat's-tail Grass. PLATE XV.

Inflorescence spicate, cylindrical. Glumes wedge-shaped, truncate, swelling upwards, mucronate; rough on the keel.

Phleum asperum, *Jacquin*. *E. B.* ed. 2. 81. P. paniculatum *of some of the older botanists*. *E. B.* 1077. Chilochloa aspera, *Römer and Schultes*.

Local rather than rare in England, where it grows in dry, open, and generally elevated meadows and pastures; as on the Gogmagog hills and in other parts of Cambridgeshire, and in meadows below King's Weston, near Bristol. Stems erect, eight inches to a foot in height, often branched; leafy almost to the inflorescence, which is sometimes nearly enveloped by the sheath of the upper leaf. Leaf-sheaths rough. Ligule blunt. Inflorescence two to four inches long, bending to one side, about the thickness of a goose-quill, but usually narrowing upwards. The form of the glumes is peculiar, widening upwards from a narrow base, and terminating abruptly, but with a short point or mucro at the broad apex: they are but slightly keeled on the back, the keel being rough, but not ciliated. The structure of the flowers is exemplified by the magnified figures: *a*, the two glumes; *b*, the single perfect flower, with its two awnless paleæ; *c*, the pistil. The second, rudimentary, flower, mentioned in our notice of the genus, is present in this species.

Annual. Flowers in July.

It seems indigenous to the upland districts of southern Europe.

PHLEUM BOEHMERI. Purple-stalked Cat's-tail Grass. PLATE XVI.

Inflorescence spicate, cylindrical, elongated. Glumes linear-lanceolate, obliquely truncate, mucronate: keel ciliated above. Paleæ nearly as long as the glumes.

Phleum Boehmeri, *Schrader*. *E. B.* ed 2. 82. *Smith*. *Hooker*. *Lindley*. *Babington*. Phalaris phleoides, *Linnæus*. *E. B.* 459. Chilochloa Boehmeri, *Beauvois*. *Loudon, Hort. Brit.* 27; *Encycl.* 58.

A local species, being apparently confined to dry sandy and chalky fields in Cambridgeshire and Norfolk. Stem decumbent at the base, slightly creeping, erect through its greater length, from a foot to eighteen inches high, simple, very slender, glossy purple, leafless at the upper part. Leaves short, scanty. Flower-spike from two to four inches long, almost strictly cylindrical, slender. The acuminate, linear-lanceolate form of the glumes is due to the obliquity of their termination; the keel is only ciliated about half its length, as shown in the magnified figure *a*. The paleæ, see figure *b*, are proportionally longer than most of the other species of the genus, being nearly equal to the glumes below the point. The rudiment of a second flower accompanies the perfect one.

Perennial. Flowers in July.

PHLEUM MICHELII. Michelian Cat's-tail Grass. PLATE XVII.

Inflorescence spicate, subcylindrical. Glumes lanceolate-acuminate, hairy and strongly ciliated throughout. Paleæ nearly as long as the glumes, hairy.

Phleum Michelii, *Allioni*. *E. B.* 2265; ed. 2. 83. Generally adopted by British botanists. Phalaris alpina, *Hænke*.

Hitherto found only in rocky places on the higher mountains of Clova, Scotland, where it was first discovered as a British Grass by Mr. G. Don. The stems are erect, varying from a few inches to a foot in height, slender and wiry. Leaves rigid, short, scanty. Flower-spike one to two inches or more in length, tapering above. The gradually attenuating form of the glumes, which terminate in a sharp point, contrasts strongly with the abrupt, mucronate character of those of all the preceding species, and, added to the great comparative length of the paleæ, will distinguish this from all its British congeners; see our magnified views. Traces of a second rudimentary flower are occasionally present within the glumes.

Perennial. Flowers in July and August. The plants have a tendency to form tufts, sending up annually, about the base of the

flowering stems, sterile leafy shoots, the preparations for the next year's flowering.

PHLEUM ARENARIUM. Sea Cat's-tail Grass. PLATE XVIII.

Inflorescence spicate, ovate, or oblong and tapering above and below. Glumes lanceolate-acuminate; keel ciliated above. Paleæ abrupt, about half the length of the glumes.

Phleum arenarium, *Linnæus*. *E. B.* ed. 2. 84. Chilochloa arenaria, *Schrader*. *Loudon, Hort. Brit.* 27; *Encycl.* 58. Phalaris arenaria, *E. B.* 222. Achnodon arenarius, *Lindley*.

Far from unfrequent on loose sandy ground near the sea-side, and often met with inland on barren sandy fields and heaths, as on that of Newmarket. Stems about six or eight inches high, generally several from the same root. Flower-spike varying in length from half an inch to one or two inches; when short, often truly ovate, otherwise fusiform or approaching even to cylindrical. Glumes lanceolate, terminating gradually in a point, ciliated or fringed about half-way down the keel. Paleæ very short, scarcely half as long as the glumes, membranaceous, broad at the top, and slightly notched.

Annual. Flowers in June and July.

Genus 8. LAGURUS. Hare's-tail Grass.

GEN. CHAR. Inflorescence spike-like. Spikelets compressed, one-flowered. Glumes two, equal, fringed with hairs, acuminated into long feathery awn-like points. Outer palea terminating in two long bristles, and furnished with a longer dorsal twisted and knee-bent awn.

Named from the Greek *lagöos*, a hare, and *oura*, a tail, in allusion to the form and appearance of the inflorescence in the only known species.

LAGURUS OVATUS. Ovate Hare's-tail Grass. PLATE XIX.

Inflorescence spicate, ovate, or ovato-cylindrical.

Lagurus ovatus, *Linnæus*. *E. B.* 1334; ed. 2. 90. Generally adopted.

Indigenous to the maritime countries of southern Europe, this beautiful grass has long been naturalized on the sandy shores of Guernsey, its only claim to admission into the British flora. The stems rise to the height of six inches or a foot, and are smooth and

slender; bearing a soft, almost silky spike of a pale whitish hue, which, in luxuriant specimens, has a length of about an inch and a quarter, with a diameter of nearly an inch at the base. The leaves are linear-lanceolate, having long inflated sheaths, by which the stem is almost completely invested. The silky appearance of the inflorescence is due to the numerous delicate hairs that fringe the glumes from the base to the extremity of their slender bristle-like terminations. These glumes are more than twice the length of the paleæ, and include the obscure rudiment of a second flower. The outer palea terminates in two bristles almost equalling it in length, and bears a very long jointed and twisted awn springing from above the middle of its back; the inner one is devoid of such appendages, but its pointed apex is more or less slightly cloven.

Annual. Flowers in June.

It is an elegant little grass, but of no economical value. Cultivated in gardens, the spikes sometimes attain a length of two inches or more and are nearly cylindrical.

Genus 9. MILIUM. Millet Grass.

GEN. CHAR. Inflorescence loosely panicled. Spikelets stalked, one-flowered. Glumes two, nearly equal, not compressed, herbaceous, broadly lanceolate, acute, longer than the flower, and enclosing it. Paleæ two, awnless; becoming hard and investing the ripening fruit.

About fourteen species are enumerated as belonging to this genus, none of which appear to be of any agricultural value. Notwithstanding the English name, it must not be supposed that the several kinds of nutritious grain called Millet are the produce of the grasses before us, all of them being derived from genera of widely different structure. In regard to the derivation of *Milium*, botanical writers are divided; some deducing it from the Latin *mille*, a thousand, in allusion to the abundance of seed produced by the numerously branched panicle of the common species; while others trace it to the Celtic *mil*, a stone or pebble, as referring to the hardness of its glossy fruit. A single species only is found in the British Islands.

MILIUM EFFUSUM. Common Millet Grass. PLATE XX.

Panicle loose, its branches spreading and subverticillate. Paleæ acute. Stem smooth. Leaves linear-lanceolate: ligule obtuse.

Milium effusum, *Linnæus*. *E. B.* 1106; ed. 2. 93. Generally adopted.

One of the most elegant of our taller grasses, and of common occurrence in moist woods and wet shady places in most parts of the kingdom. Stems from three to four feet in height. Leaves half an inch or more in breadth. Inflorescence spreading widely: branches of the panicle very smooth and slender, in distant alternate tufts, which are so arranged as to appear almost verticillate, horizontal when in flower, but eventually deflexed. The plants multiply by the root as well as by seed, sending out horizontal shoots of considerable length, in some habitats, which root at the joints as they extend.

Perennial. Flowers in June.

The compass of an octavo plate enables us to convey but a very imperfect notion of the beauty of this grass in situations favourable to its growth; the panicle is often more than a foot in length, and the slenderness of its branches such, that the small shining spikelets appear, at a short distance, as though suspended in the air. Cattle will eat it, but, as it will not grow in pastures, its capabilities for agricultural purposes need not be discussed. Sinclair, however, informs us that "birds are remarkably fond of the seeds," and remarks that "in covers, where game is preserved, there cannot be a better grass encouraged; it will save the cornfields."

Genus 10. GASTRIDIUM. Nit Grass.

Gen. Char. Inflorescence a contracted panicle, subspicate. Spikelets one-flowered. Glumes two, unequal, membranaceous, acute, awnless, ventricose at the base, much longer than the flower. Paleæ two; the lower one truncate or toothed at the apex, with or without a dorsal awn. Fruit invested by the dried paleæ.

The species, few in number, were formerly united with *Milium*, with which, however, they appear to have really no structural affinity, independent of the difference in general aspect and the form of inflorescence. The striking dissimilarity presented by their flowers will be readily perceived by comparing the magnified views of those of *Milium effusum*, Plate XX., with those of *Gastridium lendigerum*, Plate XXI., the figures marked *a*, *b*, *c*, corresponding as to the parts represented.

The name, from the Greek *gastridion*, a ventricle, or little swelling, is characteristic of the peculiar expansion of the base of the glumes.

Gastridium lendigerum. Awned Nit Grass. Plate XXI.

Inflorescence compact. Glumes lanceolate, acuminate, swollen

at the base. Outer palea awned; the awn rather exceeding the glumes.

Gastridium lendigerum, *Gaudin.* *E. B.* ed. 2. 94. Generally adopted by modern British botanists. G. australe, *Palisot de Beauvois.* *Loudon, Hort. Brit.* 25; *Encycl.* 56. Milium lendigerum, *of older authors.* *E. B.* 1107. Alopecurus ventricosus, *Hudson.*

One of the rarer English grasses, and, judging from its very local distribution, rather a naturalized visitant than indigenous. It is generally met with in fields near the sea, and especially in places where water has lain during the winter, or that are occasionally overflowed during spring-tides. The Isle of Sheppey and the vicinity of Weymouth are habitats recorded by Lightfoot and Withering; and the latter author mentions its having been found by Mr. Woodward growing among wheat, at Gillingham, Norfolk. Botanists visiting the sea-side, and desirous of adding this grass to their collections, should examine closely any low marshy spots, however unpromising in aspect, as my earliest acquaintance with it, many years ago, was made at Margate, on the site of the present railway terminus, a spot over which I have passed, more than once, in a boat in the winter-time. It is possibly less rare than generally considered. Stems from four inches to a foot in height. Leaves rough at the margins; the ligule oblong. Inflorescence varying from one to three inches in length; neither strictly paniculate nor spicate, but, even in its smallest form, composed of several apparent spikes compactly arranged upon the common rachis. Flowers glossy. Glumes peculiarly ventricose or swelling and colourless at the base, above which they contract rather suddenly into a somewhat linear-lanceolate form, the outer one especially being acuminate at the extremity; both of them are more or less finely serrulated. The outer palea terminates abruptly with three or four teeth, and bears a dorsal awn which rises beyond the glumes: the inner one is much smaller, with two teeth only, and awnless.

Annual; at least within my own experience of it in the wild state, as well as when cultivated in the garden. Others describe it as perennial, which may, possibly, be its habit in a warmer climate than that of England.

Loudon marks it as agricultural, and the abundance and nutritive character of its small seeds have led to its cultivation on some parts of the Continent. Cows and horses eat it.

Genus 11. STIPA. Feather Grass.

GEN. CHAR. Spikelets stalked, sub-racemose, one-flowered, erect. Glumes two, nearly equal, membranaceous, enclosing the flower, not compressed. Paleæ cartilaginous, hardening and investing the ripening fruit; outer one convolute, cylindrical, terminated by a very long twisted and knee-bent awn.

Between thirty and forty species of this genus have been distinguished. They are of no agricultural value, being generally grasses of rigid texture, unpalatable to cattle, and containing little nutritive matter: the grain of *S. pennata* is, however, said to produce a flower equalling that of Rice. The tough stems of *S. tenacissima* are used in Spain for making ropes, baskets, &c., a practice of great antiquity in the Peninsula, where other grasses with flexible stems are employed for similar purposes.

The name, from the Greek *stupe*, tow made from flax or hemp, by an arbitrary transition from fibre to *down* or *feather*, applies especially to *Stipa pennata*, the typical species, a reputed but very equivocal member of our English Flora.

STIPA PENNATA. True Feather Grass. PLATE XXII.

Leaves rigid, setaceous, grooved. Floral awn very long, twisted at the lower part, knee-bent, feathered above the knee to the apex.

Stipa pennata, *Linnæus*. *E. B.* 1356; ed. 2. additional plate 160*, not described in the text. Generally adopted.

Recorded in Ray's Synopsis as having been found by Dr. Richardson and Thomas Lawson, on the limestone rocks overhanging the little valley of Longsleadale, about six miles north of Kendal, in Westmoreland. We have not any authenticated instance of its discovery by later collectors on that spot or elsewhere in Britain, a circumstance which, of course, renders the fact of its existence, at any time, as an indigenous or even naturalized wild plant of this country, very doubtful; and, without impugning the veracity of the botanists above named, we can only account for its Westmoreland habitat, at the period of their researches, by the very likely accident of a seed, so admirably constructed for transportation by the wind, having found its way thither from some garden. The slender leaves grow in dense tufts, as do those of most Alpine grasses, to the length of a foot or more; they are channeled on the upper side, smooth and glossy. The roots strike very deeply into the soil, or into the crevices of rocks, from which latter it is difficult to extricate them. The flowering stems seldom attain more than the height of a foot, and are invested by leaves to the top,

the uppermost of which rise above the inflorescence. The latter is less conspicuous than that of grasses in general, until a short period before the ripening of the seed, when the long, beautifully feathered awns, sometimes a foot in length, make their appearance. Our figures show the structure of the flowers: *a*, the glumes tapering upwards and terminating in long, flexible, bristle-like points; *b*, the flower, its outer palea bearing the base of the awn; *c*, the pistil separated from the flower; *d*, the awn, attached to the outer palea as at the time of dispersion. The awn is necessarily much shortened, and it is impossible to portray on paper the beauty and silky texture of its plumes.

Perennial. Flowers in June and July.

The Feather Grass is common in many of the alpine districts of Southern Europe, whence it was introduced into the gardens of England at a very early period on account of the beautiful appendages to its fruit, a tuft of which, as remarked by Sir W. J. Hooker, "is almost as beautiful as the famed tail of the Bird of Paradise." Old Gerarde, indeed, informs us that they were worn in his time by "sundry ladies instead of feathers." The elegance of these plumes is, however, even less to be admired than the admirable mechanism of which they constitute an important part. The feathered portion of the awn is bent at an angle of 45°, and capable of being acted upon as a vane when the wind is blowing; while the base of the fruit (seed), which it terminates, is sharply pointed, so as to insure its hold on the ground in a perpendicular position wherever it may light. Thus situated, every varying breath of air communicates a more or less rotatory movement to the plume, and the necessary deep insertion of the seed is provided for by the screw-like twist of the naked part of the awn rising straight above it, the volutions of which, as they become successively buried, prevent its return to the surface. It is, in fact, thus screwed down into the light soil, in which alone it is capable of vegetating. The size of our plate does not admit of the exhibition of the plume in the position described, but the knee-like bend, the perpendicular screw below it, and the sharply-pointed base of the fruit, are sufficiently explicit of their mechanical capabilities.

No grasses root more deeply than those belonging to high alpine districts; a provision that enables their large tufts to resist the fierce action of the winds in their exposed habitats, as well as the temporary rush of the mountain-torrents, which would otherwise uproot and destroy them.

Since writing the above remarks concerning the alleged former habitat, in Westmoreland, of this curious and beautiful member of the Grass family, I have been assured that it is still to be met with, occasionally, growing in rock-fissures of the mountain limestone of the wild Pennine district of the county; a circumstance worthy

the notice of enthusiastic collectors of our botanical rarities. It may be further stated, that my informant, a native of the county, communicated the localities, more than one, in which he had himself found it; but the pleasure of research is always enhanced by the uncertainty attending its results; and, having a fellow-feeling with my friend and late pupil, against the obliteration of rare species, which has too often followed the publication of their little nooks and corners of refuge, they must here remain untold, and my kind readers rest content with a scrap of advice that no naturalist would be justified in spurning—"Search, and ye *may* find."

Genus 12. POLYPOGON. Beard Grass.

GEN. CHAR. Inflorescence more or less compact. Spikelets laterally compressed, one-flowered. Glumes two, equal, each with a long bristle-like awn arising from a little below the notched apex, longer than the flower. Paleæ two, unequal; the lower one obtuse, awned from the apex or immediately below.

A small genus of Grasses, characterized by some peculiarity in habit and, especially, by the bristly appendages of its inflorescence, whence originated the name, bestowed by Desfontaines, from the Greek *poly*, many or much, and *pogon*, beard.

The species do not appear to be of any economical value. Those of British growth, confined, almost exclusively, to maritime marshes in the south-eastern parts of England, cannot be regarded as indigenous, though the dates of their introduction by natural causes may be far from recent. Both of them may be considered as belonging to our botanical rarities.

POLYPOGON MONSPELIENSIS. Annual Beard Grass. PLATE XXIII.

Inflorescence dense, scarcely spicate, lobed. Glumes rather obtuse, rough; their awns thrice their length.

Polypogon monspeliensis, *Desfontaines*. *E. B.* ed. 2. 91. Generally adopted by modern British botanists. Agrostis panicea, *E. B.* 1704. Phleum crinitum, *Smith, Fl. Brit.* Alopecurus monspeliensis, *Linnæus*.

Found in moist pastures, chiefly near the sea or the estuaries of rivers, as on the coasts of Hampshire and Essex, about Cley in Norfolk, near Woolwich and Northfleet on the Thames, and at Inverkeithing, Fifeshire. Stems about a foot in height. Leaves few, rough on the edges. Inflorescence varying in length and

compactness; in the more luxuriant form two inches or more in length, and conspicuously branched; in smaller specimens scarcely an inch long and spike-like. Glumes hairy, rough, linear or nearly equal in breadth throughout, bifid rather than notched at the somewhat obtuse summit: their awns, generally, three times as long, but occasionally not more than twice, rough with minute points or bristles.

Annual. Flowers in July and August.

The peculiar pale, hairy, or rather silky, inflorescence of this beautiful grass renders it very ornamental, and well deserving of a place in the flower-garden; but its seeds do not appear to ripen in any abundance, and in some seasons I have known them fail altogether; a fact which may account for its sparing distribution here in the wild state. It is said to be very abundant in some of the warmer parts of Europe, which is in a degree corroborated by the specific name.

POLYPOGON LITTORALIS. Perennial Beard Grass. PLATE XXIV.

Inflorescence closely lobed or branched. Glumes tapering upwards, nearly smooth; the awns scarcely exceeding them in length.

Polypogon littoralis, *Smith*. *E. B.* ed. 2. 92. Generally adopted by modern British botanists. Agrostis littoralis, *E. B.* 1251.

Muddy salt-marshes are its favourite habitats, though it may be sometimes met with in drier situations. It is found accompanying *P. monspeliensis* in a few of its localities, on the coasts of Norfolk and Essex, as well as near the powder-magazine by the banks of the Thames about four miles below Woolwich, but must be considered more rare. Flowering stems often several from the same root, decumbent below, and rooting occasionally at the lower joints, which then send up tufts of leaves, that constitute the basis of the next year's vegetation. The fertile stems vary from a few inches to a foot or more in height. The inflorescence, more or less compact but obviously paniculate, has usually a purplish or reddish tinge, very different from the pale hue of that of the preceding species. Glumes more lanceolate than linear, though certainly not acute as sometimes described; they are hairy at the lower part of the keel, but nearly smooth above, and the awn, rarely exceeding, is often scarcely equal to them in length. The paleæ are truncated, and bifid or notched at the apex.

Perennial. Flowers in July.

Notwithstanding the very striking differences between this and *P. monspeliensis*, some of our earlier botanists seem to have con-

founded them; Withering, one of the most circumstantial writers of his time, has certainly done so under his *Agrostis littoralis*.

Sir J. E. Smith seems to have been the first who recognized *P. littoralis* as a British Grass, and it was, for some time after its discovery, regarded as a plant peculiar to England. It is now known as a native of Germany and some other parts of Europe, and its migration to our coasts may have been simultaneous with that of its congener, though circumstances hitherto have not been favourable to its equal distribution.

The magnified figures on Plates XXIII. and XXIV., lettered correspondingly, will illustrate the generic character and the differential features of the two species described.

Genus 13. CALAMAGROSTIS. Small-Reed.

GEN. CHAR. Inflorescence loosely panicled. Spikelets laterally compressed, one-flowered. Glumes two, nearly equal; much longer than the flower, which is surrounded at the base by numerous long silky hairs. Paleæ two; the lower one usually awned.

These Grasses originally composed a portion of the genus *Arundo*, from which they were separated by Adanson, chiefly on account of their spikelets being single-flowered. The separation is, however, purely conventional, and only admissible on the ground of utility; the presence of a second and, occasionally, even of a third flower, in the rudimentary state, being indicative of the close natural affinity which our classification tends to violate. The other differential characters are of trifling value.

The name adopted is that of the assumed typical species, *Arundo Calamagrostis* of Linnæus. It is a barbarous Greek compound denomination, under which the plant in question was known among the earlier botanists, derived from *calamos*, a kind of Palm, and *agrostis*, a term applied to grasses generally.

They are grasses of coarse texture, growing in wet woods and shady places in marshy ground, and are of no immediate value in an agricultural point of view, being generally left untouched by cattle. Our native species are very limited in their distribution.

CALAMAGROSTIS EPIGEJOS. Wood Small-Reed. PLATE XXV.

Panicle erect; its branches more or less compact or expanded. Flowers crowded, unilaterally disposed. Glumes subulate, rough on the keel. Basal hairs longer than the paleæ. Awn from the middle of the outer palea, and nearly equal to it in length.

Calamagrostis Epigejos, *Roth.* Adopted by most modern writers.
Arundo Epigejos, *Linnæus. E. B.* 403; ed. 2. 168.

Far from uncommon in moist woods and thickets, and about ditches and rivers under the shade of trees, especially in places liable to be overflowed.

Stems three to six feet high, terminating in a large, copiously branched, but rather compact panicle from six to eight inches or more in length. Leaves broad, harsh and rigid. The general character of the inflorescence is rather peculiar: the branches of the panicle being all directed to one side and the spikelets having a similar determination, render it not unlike an exaggerated specimen of that of the Rough Cock's-foot Grass, *Dactylis glomerata,* to which Dr. Withering compared it in the first edition of his "Arrangement of British Plants." The compressed awl-shaped glumes are rigid and rough with bristles, especially on the keel, as shown in the magnified figure at *a*. The paleæ are thin, almost membranaceous; and the awn of the outer one arises from about the middle of its back, as seen in figure *b*. Close examination will often enable us to detect the rudiment of a second flower, although it has been frequently remarked upon as absent in this species.

Perennial. Flowers in July.

CALAMAGROSTIS LANCEOLATA. Purple-flowered Small-Reed. PLATE XXVI.

Panicle erect, loose. Spikelets scattered, spreading. Glumes lanceolate, their keel smooth. Basal hairs longer than the paleæ. Awn from the base of the notch of the outer palea, very short.

Calamagrostis lanceolata, *Roth.* Most modern botanists. Arundo Calamagrostis, *Linnæus. E. B.* 2159; ed. 2. 169.

This is a more local species than *C. Epigejos,* though found, like that, in various parts of the kingdom; always in moist, and more frequently in shady situations, but occasionally in more exposed ones, especially in fenny districts. Root somewhat creeping. Stems slender, three to five feet high. Leaves narrow, linear. Panicle four to six inches long; its branches and spikelets comparatively loose, and expanding on all sides. Spikelets shining, with a tinge of rose-purple, which renders the panicle, when in full flower, very conspicuous. The glumes, figure *a*, are less attenuated than those of the last species, and nearly smooth. The short awn of the outer palea, in figure *b*, is not dorsal, but extends from the bottom of the terminating notch, in many instances scarcely rising beyond the points of the latter.

Perennial. Flowers in July.

A second, rudimentary, flower seems never to have been detected in this species.

CALAMAGROSTIS STRICTA. Lesser Small-Reed. PLATE XXVII.

Panicle erect, more or less compact or expanded. Spikelets erect, not unilateral. Glumes lanceolate, veined, the keel rather rough. Paleæ nearly equalling the glumes in length, much exceeding the basal hairs. Awn from below the middle of the outer palea and scarcely exceeding it in length.

Calamagrostis stricta, *Nuttall.* Most modern English botanists. Arundo stricta, *E. B.* 2160; ed. 2. 170. Deyeuxia neglecta, *Kunth. Macreight, Manual Brit. Bot.*

Very rare, on bogs. Discovered by the late Mr. G. Don, on White Muir Marsh, near Forfar, Scotland, where it is said no longer to exist; since found near Rescobie Loch, four miles from Forfar, and on Oakmere in Delaware Forest, Cheshire. The plant creeps at the root, sending up erect stems from two to four feet in height. The leaves vary in outline, those of the flower-stems being comparatively broad, while on the barren shoots they are much narrower, and, sometimes, even slender. Panicle two to four inches long, spreading when in flower. The glumes, figure *a*, are more or less conspicuously three-veined, especially the outer one. Of the paleæ, the outer is nearly equal in length to the inner glume, and its awn, arising from a little below the middle, extends but a short distance above its bifid or notched apex; both are considerably longer than the hairs which invest the base of the flower, figure *b*. The rudiment of a second flower is readily traceable in the spikelets of this species, in the form of a minute stalk, bearing a little tuft of hairs; and in a specimen before me this is surmounted by a third, of which the stalk or pedicel only is present, without the hairs.

Perennial. Flowers in June and July.

It appears that the second Forfarshire habitat of this Grass no longer exists, having been extirpated by drainage.

A slightly distinct variety, discovered by Mr. D. Moore on Church Island, Lough Neagh, and since found in other places in the county of Antrim, Ireland, was for a long time regarded as *Arundo lapponica* of Wahlenberg; a species which differs, however, considerably from any of British growth hitherto collected, and, especially, in having the awn geniculate or knee-bent instead of straight; while it resembles our *C. Epigejos* and *C. lanceolata* in the greater comparative length of the basal hairs, a feature certainly not appertaining to any of the Lough Neagh specimens which have come under my inspection.

Genus 14. AGROSTIS. Bent Grass.

Gen. Char. Inflorescence loosely panicled. Spikelets laterally compressed, one-flowered. Glumes two, the upper or inner one smaller, membranaceous, acute, awnless, longer than the flower. Flower sessile, occasionally with one or two tufts of very short hairs at the base. Paleæ two, the inner one rarely absent, unequal; the outer with or without an awn.

The Grasses of this genus contribute in no trifling degree to the green covering of the earth in temperate climates. Upwards of a hundred species are known; but, of this number, a few only have hitherto attracted the attention of agriculturists. Their foliage is in most instances very sparingly produced, compared with the ground occupied; the individual leaves are small and short, or thin and wiry; they flower late in the season, and their slender flower-stems are harsh and rigid. Hence in meadows reserved for mowing they add but little to the crop, and in pastures occupy space to the exclusion of others more productive, and better liked by cattle, to whose palate the Bent grasses generally seem ungrateful—indeed they often refuse hay in which any considerable quantity of them is present. To this collective character of the genus there are perhaps a few exceptions, of which certain varieties of *Agrostis alba* afford equivocal example.

The generic name was, as noticed under the last genus, a term applied to grass collectively by the ancient Greeks, derived from *agros*, a field.

There are only four species found in the British Islands, but two of these present several striking varieties.

Agrostis canina. Brown Bent Grass. Plate XXVIII.

Branches of the panicle elongated, slender, erecto-patent, rough. Glumes unequal, lanceolate, acute, rough on the keel. Inner palea minute or absent; outer one erose at the summit, four- or five-veined, with a knee-bent and twisted awn arising from below the middle and extending above the palea. Lower leaves setaceous, tufted; those of the stem narrow linear; sheaths smooth; ligule oblong, acute.

Agrostis canina, *Linnæus. E. B.* 1856; ed. 2. 96. Most modern authors. Trichodium caninum, *Schrader. Lindley. Loudon, Hort. Brit.* 26, *Encyc.* 56.

Often very abundant on moist heaths and moors. Its long, trailing, leafy shoots root at every joint, forming the setaceous tufts

above described. The flower-stems, decumbent below, rise to the height of a foot or eighteen inches, terminating in a rather lax, rough panicle four or five inches in length, the single-flowered spikelets of which being stalked, and expanding at the time of flowering, renders the appearance of the inflorescence very light and elegant; this is the state represented in our figure, but it afterwards becomes more compact. The glumes, at *a*, are only rough on the lower part of the keel. The flowers vary much in colour, according to circumstances of soil and situation, assuming different shades of brownish purple and green. The jointed awn is sometimes scarcely higher than the palea, in other instances it will exceed the glumes; the figure of a flower at *b* shows it of a medium length.

Perennial. Flowers from the end of June to August.

The genus *Trichodium*, to which this species is referred by some botanists, was separated from *Agrostis* by Schrader, on account of the absence of the inner palea: such appendage is, however, seldom altogether absent, though generally only traceable as a minute point; and this circumstance, associated with its small development and even occasional abortion in other species of *Agrostis*, renders the separation useless. Dr. Lindley, in his later and most valuable work, 'The Vegetable Kingdom,' adopts this view, recording *Trichodium* only as a synonym of *Agrostis*.

Rather to be regarded as a troublesome weed than as a grass of any agricultural value. It vegetates early, but the produce is too trifling to render that of any account, while during the first summer droughts the tufts of slender involute leaves assume a parched and withered appearance that denies all promise for the future.

AGROSTIS SETACEA. Bristle-leaved Bent Grass. PLATE XXIX.

Panicle slender, oblong; its branches short, few-flowered. Glumes unequal, lanceolate, acute, rough on the keel. Outer palea erose at the summit, four-veined, the lateral veins terminating in short setæ; with a knee-bent twisted awn, arising from near the base, and about twice the length of the palea. Inner palea very small. Leaves setaceous; sheaths rough; ligula oblong, acute.

Agrostis setacea, *Curtis*. *E. B.* 1188; ed. 2. 97. Chiefly adopted.
Trichodium setaceum, *Michaux*. *Rœmer*. *Lindley*. *Loudon*, *Hort. Brit.* 26; *Encyc.* 56.

Found, almost exclusively, on dry heaths and downs in the south-western counties of England from Cornwall to Hampshire, especially toward the sea-coast; a circumstance indicating its probable migration thither from the south-western parts of Europe. In Spain and Portugal it is a very common grass, and its original transport from the shores of the latter country is farther countenanced by

the naturalization of *Erica vagans, E. ciliaris, Reseda fruticulosa,* and other continental plants in Cornwall and the south of Ireland. The grass before us seems to be extending itself eastward in England, as I found specimens of it among two small collections made by my pupils this summer, 1857, on the line of the south downs of Kent and Sussex. It grows in tufts among heath and furze. The flowering stems, rising to the height of a foot or more, are very slender and rigid; the leaves short, narrow, and rolled inward so as to be almost hair-like. When in flower, the panicle spreads, but it collapses on being gathered; and, in its earlier and later stages of development, the branches, which in our native specimens are always very short, lie so close to the rachis as to render the appearance of the inflorescence spicate. The outer palea is pale and membranaceous, with four strongly marked green veins, the two lateral of which are prolonged beyond the truncated erose summit: its long, twisted and jointed awn is attached only at the base. The inner palea is either so small, that it may be termed minute, or is absent or only rudimentary; a small tuft of white hairs arises on each side of the base.

Perennial. Flowers in June and July.

Sheep avoid this grass generally, unless in default of the more grateful and nutritive species.

AGROSTIS VULGARIS. Fine Bent Grass. PLATE XXX.

Panicle loose; its branches and branchlets spreading, nearly smooth. Glumes nearly equal; the outer one toothed on the upper part of the keel. Outer palea sometimes awned, three-veined; inner bifid at the apex, two-veined. Ligule very short, truncate.

Agrostis vulgaris, *Withering. E. B.* 1671; ed. 2. 98. Generally adopted.

One of our most common grasses, though preferring rather dry soils and situations. It creeps at the base, sending out long prostrate shoots which root at every joint, producing stems the following year. The flowering stems are decumbent and rooting at the lower part, ascending and erect above, having the ordinary height of a foot or a foot and a half, and terminating in a very loose, spreading, purplish panicle, three to six inches long. The flowers are small and pedicellate; the pedicels rough, though the rachis and its branches are nearly smooth. Glumes lanceolate, acute, nearly equal in length, very smooth and glossy; the outer one strongly serrulated at the upper part on the keel. Outer palea very little shorter than the glumes, three-toothed at the apex, and with three veins, mem-

branaceous, either awnless or with an awn of varied length springing from the central vein and from about the middle of its back. Inner palea about half the length of the outer, two-veined only and two-toothed at the summit. The characters of the glumes and paleæ will be seen in our magnified figures *a* and *b*, the latter exhibiting the flower in its usually awnless condition.

Perennial. Flowers in June and to the beginning of August.

A small variety, occasionally met with on poor sandy soil, not more than two or three inches high, is the *Agrostis pumila* of Lightfoot, Flora Scot. p. 1081, fig. in title-page. To the remark of Withering, that, when cultivated in a garden from seed, this variety assumed the ordinary size and habit of *A. vulgaris*, I can testify from my own experience. Mr. Babington observes that it is "usually infested with smut;" a circumstance far from unfrequent, however, with this species in moist or otherwise unfavourable situations. There are, certainly, not any decided varieties of this common grass. It is not one of any agricultural value, unless in permanent pastures, where the early development of its foliage is, perhaps, of some account, as it is almost exclusively the spring produce of the Bent Grasses which cattle in general will eat.

Sir W. G. Hooker mentions his possession of "specimens of this species bearing the rudiment of a second flower upon a rather long footstalk, in the same calyx," that is, within the same glumes or spikelet,—a fact indicative of the very arbitrary rules upon which our genera are based.

AGROSTIS ALBA. Marsh Bent Grass. PLATES XXXI. & XXXII.

Panicle loose; its branches and branchlets ascending, hispid. Glumes nearly equal; the outer one with its keel toothed throughout. Outer palea rarely awned, five-veined; inner two- or three-veined; both somewhat obtuse and toothed. Ligule long, acute.

Agrostis alba, *Linnæus. E. B.* 1189; ed. 2. 99. Generally adopted.
A. stolonifera, *Linnæus. E. B.* 1532. *Sinclair. Loudon*, and others. A. palustris, *Sinclair.*

Very common, and even abundant, throughout the kingdom; chiefly, though not exclusively, in a moist soil and situation, and assuming a variety of aspects, which the earlier botanists regarded and described as so many distinct species. The tendency to spread and creep from the root is far more strikingly evinced in this plant than in the preceding, *A. vulgaris*, and it is at the same time much stouter and taller, under most circumstances, than that species. Growing in only moderately moist meadows and pastures, or on road-sides, the difference in habit is less remarkable than it is elsewhere; and a strict attention to the specific characters, as above

given, will be necessary to their distinction. The magnified views, *a* and *b*, will show the entire serrulation of the glume-keel and more complex veining of the outer palea in the present species; added to which the panicle is of a paler hue, and the branches and branchlets, though similarly disposed, are less divaricated, pointing upwards, and eventually closing upon each other instead of spreading horizontally, as do those of *A. vulgaris* both during and after flowering.

Perennial. Flowers late in July.

The two figures, given in plates 31 and 32, exhibit extremes in the form of the panicle; the first representing the normal condition of *A. alba*, the second, one of the many varieties included under *A. stolonifera* of Linnæus and some later botanists. They cannot be retained as distinct species, and I have preferred giving an example of the latter from a specimen in the English Botany herbarium, to leaving it without illustration or selecting one more nearly approaching the ordinary inflorescence of *A. alba*, exhibiting, as it does, one of those remarkable departures from mere superficial resemblance that occasionally occur among the species of the vegetable kingdom.

The Marsh Bent Grass is a troublesome weed in gardens, and likewise on heavy arable land, being with difficulty separated from the latter when it is broken up. It is one of the grasses commonly known by the names of *squitch* and *quick*, probably in allusion to the tenacity with which its creeping stems, or stolones, retain their vitality when removed from the soil. The variety *stolonifera*, so called from the number and extension of these stolones, has been long a subject of interest and inquiry among agriculturists, on account of the enormons produce attributed to it by some observers. It was one of the species noticed by Dr. Maton on a small tract of meadow land at Orcheston, near Salisbury, remarkable for the quantity of hay yielded by it in favourable seasons; and which, mown twice a year, amounted to near five tons per acre for the first crop and about half as much for the second. The land in question, two acres and a half in extent, is described, however, as peculiarly circumstanced, being occasionally inundated during the winter by a spring flowing out of a limestone rock; and the proportion in which this grass existed upon it seems doubtful, as it was accompanied by *Poa trivialis*, the Rough Meadow Grass, and specimens of both species were collected measuring from seven to ten feet in length. Farther, and perhaps more direct attention to its merits as an agricultural grass, was excited by Dr. Richardson, under its Irish appellation of Fiorin, and numerous experiments were made in regard to its capabilities in cultivation, the general results of which do not appear to have proved very favourable: in the account given of those at Woburn it is observed, that it appears

to possess "merits well worthy of attention, if the natural place of growth and its habits be impartially taken into consideration;" but that these merits are perhaps not so great as has been supposed.

The following summary concerning the agricultural use of *A. alba* appears in the second edition of 'English Botany.' The value of all the varieties depends upon the creeping stems, which afford a heavy crop of hay late in the year, and also supply leaves for early feeding. That variety found on old rich pastures (the Fiorin) is by far the best, being altogether of larger growth. To make this thrive, a regular supply of manure upon a moist stiff soil is required, while some of the other varieties do best upon sandy ground. Mr. Sinclair recommends the Fiorin to be mixed with other grasses, to prevent its stems being trodden into the ground by cattle, that they may form part of the crop, which is most productive in December.

As is the case with plants generally which propagate themselves abundantly by lateral extension, the Fiorin produces little seed; hence, those who are desirous of cultivating it, will succeed best by planting cuttings of the creeping stems in drills an inch deep, and slightly covering them with soil.

The creeping stems, runners, or stolones of this *Agrostis* and many other grasses of similar habit are highly nutritive; and in Italy and the south of France the poor people collect them by the roadsides and elsewhere, binding them in small bundles, which they carry to market for sale as food for horses. This is a fact deserving our consideration while endeavouring to arrive at a just appreciation of the agricultural capabilities of the Marsh or Creeping Bent Grass, because it affords positive evidence in favour of its foodful qualities when growing naturally. But, unfortunately, practical men are too prone to overlook natural adaptation, and expect more than is consistent with the general laws of organization. The Orcheston Long Grass and the Fiorin of Nature's own planting flourished in the rich, well-watered, and retentive soil of the permanent pasture, to the production of an almost miraculous amount of fodder; but it is surely unreasonable to suppose that, in the absence of such conditions, and especially under the rotation system at present followed, any parallel success can attend the cultivation of the species. The Creeping Bent may be a useless weed, wiry, nearly leafless, and unpalatable to cattle, or succulent, abundant in foliage, and as grateful to them as it is productive; some of the richest cow-pasture, below the embankments of the Lea, near London, consisted almost entirely of this grass and *Poa trivialis*: see our plate 64; but it was intersected by ditches, into which the water of the river was repeatedly admitted by sluices during dry weather.

Genus 15. APERA. Wind Grass.

GEN. CHAR. Inflorescence loosely panicled, or narrow and contracted. Spikelets laterally compressed, one-flowered. Glumes two, the outer or lower one smaller, membranaceous, acute, awnless. Flower with hairs at the base, accompanied by the pedicel-like rudiment of another. Paleæ two, unequal; the outer with a long, nearly terminal awn.

The difference of character between this genus and *Agrostis* rests chiefly upon the comparatively smaller size of the lower glume, and the very long and nearly terminal awn of the outer palea: added to which, there is the minute, stalk-like rudiment of a second flower, with a small tuft of hairs on each side, at the base of the inner palea, and therefore superior. Such appendages are but rarely traceable in the spikelets of the latter genus, in which the species of *Apera* are sometimes included.

The name, rather arbitrarily bestowed by Palisot de Beauvois, is from the Greek, signifying literally *without mutilation*, and applies to the constant presence in these plants of the long floral awns, organs which in *Agrostis* are either comparatively very short or wanting altogether.

APERA SPICA-VENTI. Spreading Wind Grass. PLATE XXXIII.

Panicle loose; its branches and branchlets spreading, elongated, slender. Glumes unequal, lanceolate, rough on the keel. Outer palea bifid at the apex, with a long, nearly terminal, straight awn; the inner one smaller. Anthers linear-oblong.

Apera Spica-venti, *Beauvois, Babington.* Agrostis Spica-venti, *Linnæus. E. B.* 951; ed. 2. 95. Anemagrostis Spica-venti, *Trinius, Parnel, Lindley.*

Though scarcely to be considered rare, this is far from being a common grass. It is, perhaps, more frequently met with in the vicinity of London than elsewhere throughout the kingdom, especially in some parts of Surrey and Essex; growing almost always in a sandy soil, and preferring spots that are occasionally inundated, sometimes in cornfields. Stems slender, one to three feet high. Leaves rough. Panicle from three or four inches to a foot in length; its longer branches often three inches or more, all very slender and more or less waved and spreading. Spikelets small, stalked, and distant. Awn several times longer than the palea, rough, inserted a very little below the bifid, or deeply-notched extremity. Inner palea scarcely shorter than the outer. The magnified figure *a* shows the unequal glumes, the outer of which

is the smaller; *b* is the solitary flower, exhibiting the nearly equal size of the paleæ, the insertion of the long, rough awn, and the form of the anthers.

Annual. Flowers from June to August.

Where found, it is generally abundant, and easily recognized at a considerable distance by the delicacy of its ample, glossy, and silk-like inflorescence, agitated by every breath of air. It is one of the most beautiful of our grasses, and deserving a place in every flower-garden, growing readily from seed, which ripens about the end of August.

It is not of any agricultural value, dying away early in the season, in most instances before the ripening of its seed, as occurs with many annual grasses which vegetate in dry situations.

APERA INTERRUPTA. Dense-flowered Wind Grass. PLATE XXXIV.

Panicle slender; its branches directed upwards. Anthers roundish oval.

Apera interrupta, *Beauvois, Babington. E. B. Supp.* 2951. Agrostis interrupta, *Linnæus, Hooker and Arnott.* Anemagrostis, *Trinius.*

First noticed wild in England growing near Thetford, Norfolk, in June 1847, by the Rev. W. W. Newbould; since met with in Cambridgeshire and elsewhere. It seems confined to sandy districts, and to flourish in more arid situations than *A. Spica-venti*, as supposed meagre specimens of which it had probably been overlooked by previous botanists in the few habitats hitherto recorded. Stems often several from the same root, rarely more than a foot in height, and often only a few inches. Panicle-branches rising almost parallel with the rachis, never spreading as in the preceding species; growing in imperfect whorls, which, being distant from each other, especially at the lower part of the contracted panicle, give the latter the appearance of division into stages, whence the Latin name, *interrupta*. The flowers correspond in structure with those of the Spreading Wind Grass, except in the form of the anthers, which, as shown in figure *b*, are proportionally shorter, their length and diameter being nearly equal. The greater length of the awn and more spreading stigmas are features liable to vary. Figure *c* shows the stalk-like rudiment of the second flower observable in the spikelets of this genus.

Annual. Flowers in June and July.

Long recognized as a distinct species in central and southern Europe, from which its rarity in our island seems to indicate it an accidental wanderer. We must, I suppose, admit its claim to rank

as such; but the non-extension of the branches of a panicle is not of the slightest importance as a distinctive character, unless in association with others, and the difference in the form of the anther a very equivocal one; indeed, the latter is not an improbable result of the constitutional defect by which the former is induced. *Apera interrupta* is not, however, the only uncertain species which the artist may figure and the author describe; and its illustration, whether species or variety, is equally useful, and essential to the value of their work as one of general reference.

Genus 16. CATABROSA. Whorl Grass.

Gen. Char. Inflorescence loosely panicled; branches spreading. Spikelets stalked, ovate, one- to three-flowered. Glumes two, unequal, concave, very obtuse, membranaceous, much shorter than the spikelets; the lower one-veined, oblong; the upper three-veined, obovate, twice as large, eroded at the apex. Paleæ two, nearly equal, somewhat coriaceous, oblong; the lower three-veined, rounded at the apex; the upper two-veined, truncated, and eroded.

This genus, the typical and perhaps only true species of which was formerly assigned to *Aira*, is readily distinguished from the latter by the very obtuse termination of the glumes. The number of perfect flowers in each spikelet is usually two, but occasionally a third is found; and sometimes even the rudiment of a fourth flower presents itself, showing the tendency to profuse development which characterizes the inflorescence of *Glyceria*, *Poa*, and some other genera regarded as widely dissimilar.

The name, from the Greek *catabrosis*, a gnawing, applies to the eroded or irregularly-notched extremity of the glume.

Catabrosa aquatica. Water Whorl Glass. Plate XXXV.

Panicle pyramidal; with alternate half whorls of spreading branches. Leaves broadly linear, obtuse.

Catabrosa aquatica, *Beauvois*. Generally adopted by modern botanists. *E. B.* ed. 2. 110. Aira aquatica, *Linnæus*. *E. B.* 1557. *Loudon, Encyc.* 58. Poa airoides, *DeCandolle*.

A common grass in watery situations, and about the banks of rivers, ditches, and pools, where the flowering stems often rise among the reeds and other herbage to the height of two or three feet; or, extending into the water, float upon the surface, sending out fibrous rootlets from every joint, and becoming branched. Leaves broad, flat, flaccid, sometimes very short, but not unfre-

quently growing to a considerable length, especially in running water. Panicle large and handsome in luxuriant specimens, consisting of several, alternately disposed series of semi-whorls of from five to three branches each. The short lower glume is always distinctly one-veined, but the veining of the upper one is often obscure: the broad blunt terminations of these, and of the paleæ likewise, contribute to render the generally two-flowered spikelets peculiarly compact in their oval outline. In the magnified figure *a*, the form, proportion, and veining of the glumes is shown; in *b*, a spikelet of two flowers, one being expanded.

Perennial. Flowers in June and July.

A small variety of this species is occasionally met with, growing in sand on the sea-shore, chiefly on the western side of the island. It is often not more than two or three inches high. The spikelets are only one-flowered.

The panicle of the Water Whorl Grass has, when growing exposed to the sun, a beautifully variegated appearance, the glumes being tinged with purple or pink, and the paleæ brownish-green with white or very pale green extremities, the whole contrasting well with the yellow or orange-coloured anthers.

Being an aquatic plant, it is of course in a great measure beyond the limit of cultivation for hay or pasture; but all cattle, cows especially, seem to relish it exceedingly; indeed, I have often seen the latter standing midway in the pools, in which it grows floating, in order to feed upon its sweet succulent shoots and foliage. Geese, ducks, and other water-fowl are equally fond of it; hence its introduction into decoys for wild birds of the kind has long been practised, by throwing the floating stems into the water with weights attached to them.

Genus 17. AIRA. Hair Grass.

Gen. Char. Inflorescence paniculate, more or less spreading. Spikelets stalked, laterally compressed, two-flowered, rarely three- or one-flowered. Glumes two, nearly equal, scarcely shorter than the spikelet. Paleæ two, membranaceous, often hairy at the base; lower one bifid or toothed at the apex, awned at the back. Fruit glabrous.

The English name of these grasses refers to the slender leaves characterizing most of the species, which are numerous and widely distributed, generally in dry open situations, of which they sometimes constitute the principal vegetation. The British species are regarded rather as weeds than as of any utility in an agricultural point of view. The larger kinds are too coarse and wiry to form

good hay, and cattle will rarely eat any of them in the growing state, sheep being the only pasturing animals to which they seem at all palatable.

The generic name is Greek, from the verb *airo*, to kill or destroy, and was applied to the Bearded Darnel Grass, in allusion to the deleterious effects resulting from the use of its seeds: hence it is altogether meaningless as now bestowed on a family of grasses, the species of which, if not highly nutritive, are at least harmless.

The genus is in an unsettled state, being considered by some botanists susceptible of division into three or four; but as our indigenous species are few, and the distinctive characters of the alleged genera, perhaps with one exception, very far from definite, they are here more conveniently arranged, under the same name, in two sections.

* Lower palea truncate, crose at the apex. Fruit free. *Deschampsia*, Beauvois, and *Aira* proper.

AIRA CÆSPITOSA. Turfy Hair Grass. PLATE XXXVI.

Panicle spreading; its branches scabrous. Glumes slightly rough on the midvein. Flowers hairy at the base, two, with the rudiment of a third; or, rarely, one only. Awn straight, arising from below the middle of the lower palea and seldom exceeding it in length. Leaves flat. Ligule acute.

Aira cæspitosa, *Linnæus. E. B.* 1453; ed. 2. 104. Most British botanists. Deschampsia cæspitosa, *Beauvois. Lindley. Macreight.*

This is a common species in moist meadows and woods, and on hill-side pastures where the ground is wet or springy. In such situations it is generally very conspicuous in consequence of forming large tufts that rise above the surrounding vegetation. Under the shade of trees, the stems often rise to the height of three or four feet, but in more exposed habitats average between one and two feet only: they are usually few in number compared with the size of the tufts, slender, erect, and rigid. Leaves long, flat, linear, acuminate, rough, on the sheaths and margins especially. Panicle large, six to ten inches high and about as broad at the lower part; its branches slender, rough. Spikelets small, silvery-grey or purplish. Paleæ very obtuse, the upper bifid, the lower erose; the lower with two conspicuous veins on each side of the central one, which separates from it a little below the middle, forming the straight, rough dorsal awn. Figure *a* shows a two-flowered spikelet, with its nearly equal lanceolate glumes, which are rough on the

keel; *b*, a separate flower with a few hairs at the base, the characters of the paleæ and the awn.

Perennial. Flowers from July to September.

The general aspect and certain secondary characters of the species are liable to vary in mountainous habitats, and two of the forms thus induced are distinguished by name.

β. *brevifolia*, Parnell. This has the radical leaves short, with smooth sheaths; the panicle small; the awn about the length of the flower.

γ. *longiaristata*, Parnell. Awn one-third longer than the flower. Occasionally this has only one fertile flower in each spikelet.

Another form found in corresponding situations to the two preceding is the viviparous; in which the flowers instead of producing fruit or seed develope buds, that, beginning to vegetate upon the panicle, eventually drop off, and rooting where they fall, multiply the species. This is not an uncommon circumstance among alpine grasses, an example or two of which we shall take occasion to figure in the course of our work. The viviparous forms are retained for years under cultivation in the garden; but I have not found this to be the case with the other varieties of the species before us; they have gradually merged into the ordinary condition of the lowland plant. All these varieties are liable to be mistaken by an inexperienced collector for the following species, *A. alpina*, and I fear that the assumed different position and character of the awn will not readily determine the question.

The Turfy Hair Grass is a troublesome weed in marshy meadows, where its tufts occasion little hillocks which interrupt the sweep of the scythe and blunt its edge; while no feature is more indicative of neglect or carelessness on the part of the farmer, or gives a more slovenly appearance to his land, than the accumulation of Tussocks, Hassocks, Rough-caps, or Bull's-faces, as they are variously termed in provincial dialect. Pigs seem to be the only animals that eat this grass with any relish, though it is occasionally cropped by cows when the pasture is overstocked. By horses it is rarely, if ever, touched, and sheep never take it while better food is to be had. The harshness and strong flavour of the abundant foliage will account for this almost universal dislike, in the absence of analysis to determine its want of nutritive principles as compared with other grasses. Of course a plant so circumstanced must always be regarded, in an economical point of view, as occupying space which might be more advantageously employed. In well-drained land it rarely intrudes; but when once it obtains a place in the permanent pasture, the sooner it is destroyed by paring up and burning the tussocks the better.

In the economy of Nature, these tufts, so unsightly and disfiguring to the cultivated landscape, are valuable, by contributing

to elevate and solidify low lands liable to be overflowed by rivers; and, where they occur on hill and mountain slopes, by binding the spongy soil and preventing the slips which would leave them bare.

AIRA ALPINA. Smooth Alpine Hair Grass. PLATE XXXVII.

Panicle rather contracted; its branches smooth. Glumes smooth on the midvein. Flowers hairy at the base; two, with the rudiment of a third. Awn bent, twisted at the base, arising from above the middle of the lower palea and scarcely exceeding it in length. Leaves involute.

Aira alpina, *Linnæus*. *E. B.* ed. 2. 105. Generally adopted.
A. lævigata, *E. B.* 2102.

Found growing in the moist crevices of rocks about the summits of the Highland and Welsh mountains. In these habitats it has rarely the tufted character of the preceding species, but often exhibits a tendency to creep and send out stolones. The stems are seldom more than a foot high, and occasionally only three or four inches. The leaves are short, turned inwards on the margins, which gives them a narrow appearance, rigid, and roughish on the upper surface. The panicle varies much in size and compactness, being in some instances more expanded than represented in our figure, in others having the branches almost close. The spikelets are much larger than those of the normal form of *A. cæspitosa*; they are far more frequently viviparous than fruit-bearing. The awn, though usually arising from above the middle of the back of the lower palea, has sometimes a lower attachment; neither is its bent and twisted character always appreciable.

Perennial. Flowers in July.

This differs sufficiently from the last in general aspect to admit the probability of its being a distinct species, were the above-mentioned varieties wanting, but their occurrence renders the question doubtful. Having only grown the viviparous form of *A. alpina*, I have no evidence to adduce concerning its suspected identity with the alpine conditions of *A. cæspitosa*, but believe in it notwithstanding.

AIRA FLEXUOSA. Waved Hair Grass. PLATE XXXVIII.

Panicle spreading; its branches waved. Glumes roughish on the midvein. Flowers hairy at the base; two, with the rudiment of a third. Awn jointed, arising from near the base of the lower palea, and extending considerably beyond its apex. Leaves almost setaceous. Ligule truncate.

Aira flexuosa, *Linnæus*. *E. B.* 1519; ed. 2. 106. Generally adopted.

Abundant on heaths and dry upland pastures throughout the kingdom. It forms somewhat creeping tufts of nearly smooth, narrow, bristle-like leaves, among which rise numerous slender, wiry stems about a foot in height. Panicle two or three inches long, spreading when in flower; its rachis and branches more or less waved or zigzag. Spikelets glossy, purplish, chiefly directed to one side. Awn knee-bent, half as long again as the palea.

Perennial. Flowers in July and August.

A variety with smaller and more compact panicle, and with the lower flower a little longer than the glumes, was *A. montana* of some of our older botanists.

It is not a grass deserving any attention in cultivation, but in the dry natural pastures where it flourishes the sheep seldom allow it to flower.

** Lower palea bifid at the apex: both hardening and enclosing the fruit. *Airopsis*, Fries.

AIRA CARYOPHYLLEA. Silvery Hair Grass. PLATE XXXIX.

Panicle spreading, with ternate branches. Spikelets rounded below. Flowers two, shorter than the glumes. Awn arising from below the middle of the lower palea, and extending beyond the glumes. Leaves short, narrow.

Aira caryophyllea, *Linnæus*. *E. B.* 812; ed. 2. 109. Generally adopted by British botanists. Avena, *Koch*.

Common on dry sandy or gravelly heaths and pastures, where its slender stems vary in height from two or three inches to a foot. Leaves very few, narrow, sometimes almost bristle-like; their sheaths rough. Panicle spreading in maturity; its branches growing by threes and dividing on the same plan, very slender, often slightly flexuose, but never zigzag like those of *A. flexuosa*. Spikelets small, silvery-grey, obtuse or rounded at the base; two-flowered, without any rudiment of a third. Flowers destitute, or nearly so, of hairs at the base. Glumes ovato-lanceolate, pellucid at the upper part. Paleæ hardening eventually over the ripening fruit. Awn twice as long as the bifid lower palea from below the middle of which it arises.

Annual. Flowers in June and July.

A very elegant and ornamental grass, but its foliage is so scanty as to yield little nutriment, and place it beyond the pale of cultivation.

AIRA PRÆCOX. Early Hair Grass. PLATE XL.

Panicle compact, often spicate. Spikelets two-flowered. Awn from below the middle or near the base of the outer palea, extending beyond its bifid apex. Leaves short, narrow; their sheaths smooth.

Aira præcox, *Linnæus*. *E. B.* 1296; ed. 2. 108. Generally adopted by British botanists. Avena, *Koch*.

Very frequent on sandy heaths and commons and by roadsides. The stems, from one to five or six inches high, rise erect, usually several from the same root amidst a tuft of small, almost setaceous leaves. Panicle of few branches, and, even in larger specimens, scarcely expanding as such; while in those of average and smaller size, the spikelets are nearly sessile, giving the inflorescence the character of an oval or oblong spike, varying from half an inch or less to an inch in length: the colour when in flower is a pale greenish-grey. The glumes are ovate-lanceolate, but less inflated or turgid at the base than those of *A. caryophyllea*; hence the spikelets are less rounded below than in the latter species. The length and insertion of the awn are variable, but it is always extended considerably beyond the bifid extremity of the palea. No rudiment of a third flower is traceable.

Annual. Flowers in April and May.

It is difficult to frame a specific character of distinction between this and the preceding species, except from the compactness of the panicle and comparatively larger size of the spikelets in the present. Their general appearance is, however, so very dissimilar, as to render mistake by the most superficial observer next to impossible. Our figures express the peculiarity of habit, laxity in the one and rigidity in the other; and though in small specimens of *A. caryophyllea* these features are less exaggerated, they will still be found, on comparison, sufficiently expressive to keep apart two plants, which, with many common characteristics, have no real affinity beyond association in the same genus.

It will be observed, by reference to the sectional arrangement and synonyms of the five British species of *Aira* above described, that they have been regarded by different botanists as involving types of three distinct genera, *Deschampsia*, *Aira*, and *Airopsis*. In a local monograph, like that before us, such a division, founded between the first two upon very equivocal features, and not generally adopted in either instance, has been avoided as unnecessary to accuracy of description, and tending to complicate the subject. But the attention of every practical botanist must be arrested by the fact, that the two species, composing our second division, are

separated from their assumed congeners, by a feature of far greater importance than the relative dimensions of a glume or palea or the twisting or insertion of an awn; namely the hardening of the paleæ around the ripening fruit, a character involving physiological, not mere accidental, difference in development. The reference of our Silvery and Early Hair Grasses to *Avena*, the Oat family, on this consideration, is scarcely consistent with other circumstances; but the genera of the grasses are at present, almost throughout, highly unsatisfactory: to revise and establish them on a firmer foundation would be the labour of a life—our work must float with the tide.

Genus 18. CORYNEPHORUS. Club Grass.

Gen. Char. Inflorescence paniculate, more or less dense. Spikelets stalked, two-flowered. Glumes two, nearly equal, longer than the flowers. Paleæ two, membranaceous; the lower one entire, awned above the base. Awn straight; jointed in the middle, with a tuft of hairs at the joint; club-shaped above.

This genus was separated from *Aira* by Palisot de Beauvois, in consequence of the peculiar structure of the awn in *A. canescens* of Linnæus, for which see our magnified view of the flower in Plate XLI.

The name is from the Greek *koryne*, a club, and *phoreo*, to bear; in allusion to the club-like extremity of the awn.

Corynephorus canescens. Grey Club Grass. Plate XLI.

Panicle rather compact than spreading. Glumes longer than the flowers, acuminate. Awn arising from near the base of the palea. Leaves slender.

Corynephorus canescens, *Beauvois, Lindley, Babington, Macreight, Loudon.* Aira canescens, *Linnæus. E. B.* 1190; ed. 2. 107. *Hooker and Arnott.*

Not strictly indigenous, but in many places abundant, on the sandy sea-coasts of Norfolk, Suffolk, Dorset, and the Channel Islands. Stems slender, six inches to a foot in height, often many from the same root. Leaves very narrow, nearly setaceous. Panicle, in its full development, spreading, but more frequently compact, or interruptedly spicate; often, when in flower, scarcely escaping from the sheath. Spikelets variegated, purple and white, small, stalked. Anthers purple. Awn straight, rising from near the base of the outer palea; jointed about the middle; the lower part thicker, cylindrical, striated, and twisted, brownish-yellow, opake, terminating in a circular tuft of short bristles; upper part club-

shaped, whitish tinged with purple, translucent, articulated to the broad summit of the lower, and surrounded at the base by the ring of bristles, as seen in our magnified figure.

Perennial. Flowers in June and July.

An elegant little grass, when the panicle expands in full flower. Interesting to the botanist on account of the peculiar character of the awn; but of no value to the cultivator,—a consequence rather of the scanty foliage than of its being ungrateful to cattle, as I have seen it eaten down in its natural habitats both by cows and sheep.

Genus 19. MOLINIA.

Gen. Char. Inflorescence paniculate, contracted or spreading. Spikelets stalked, one- to three- or more-flowered. Glumes two, unequal, acute, one-veined, shorter than the contiguous flowers. Paleæ two; the lower one entire, smooth, rounded on the back, eventually hardening around the upper one and enclosing it with the fruit.

Originally confounded with the following genus, *Melica*, from the general character of which, however, our solitary British species differs considerably. The number of perfect flowers in each spikelet varies from one to five or six, and, even with the latter number, the rudiments of one or two others may sometimes be traced; showing a tendency to super-development that in some instances completely alters the aspect of the plant. Named in commemoration of Giovanni Ignatio Molina, the author of the 'Natural History of Chili,' published in 1782.

Molinia cærulea. Lavender Grass. Plate XLII.

Panicle erect, more or less contracted. Spikelets erect, cyliudrical. Outer palea three- or, sometimes, five-veined.

Molinia cærulea, *Mœnch. Lindley.* Most modern British botanists.
Melica cærulea, *Linnæus. E. B.* 750; ed. 2. 117. Aira, *Hudson.*

Frequent on moors and wet heaths, where its numerous slender, bluish-purple panicles render it very conspicuous during the flowering season. It forms dense tufts, which often present an almost bulbous appearance at the base, especially when growing about the borders of pools or in bogs, owing to the bottoms of the last year's leaves becoming persistent and of a fleshy texture; on drier ground this peculiarity is less marked. Leaves long, narrow, linear-acuminate, flat, usually having a glaucous hue. Stems slender, wiry, from six inches to two feet high; leafless at the upper part, owing to the absence of nodes or joints, of which there

is generally only one near the base. Panicle in most instances erect and very close, especially when simply branched; but in exceedingly luxuriant specimens with elongated and dividing branches, it sometimes assumes a slightly curved and unilateral character: the length varies from two to six or eight inches. Spikelets purple, rarely greenish, mostly only two- or three-flowered, with a terminal rudiment of another. Anthers deep purple.

Perennial. Flowers in July and August.

The diversity of size, general aspect, and corresponding difference in the development of the panicle, have induced some botanists to record mere accidental, or, at farthest, local varieties, as species. Such are: *M. depauperata*, Lindley. A variety first noticed by the late Mr. D. Don, on the Clova mountains of Scotland, where it grows at an elevation of 3000 feet, and named by him *M. alpina*: in this the spikelets are only one-flowered; but, cultivated in the garden for a few years, it shows no difference from the common-form of the species on the heaths around London.

Another form, perhaps not met with in Britain, is *M. altissima*, Link: with stems sometimes three or four feet high, a long branched panicle, and many-flowered spikelets.

The slender rigid stems have considerable elasticity, and are employed in some parts of the West of England to make brooms, which for ordinary purposes are used as substitutes for those made of hair. They are not very durable, but sufficiently cheap to render deficiency in that respect of little importance, and the collection of material, the simple manufacture and sale about the country afford occupation and subsistence to many poor people. Sinclair remarks upon the presence of this grass as useful in indicating those deep peat soils which are adapted for the production of Ash, Alder, and Willow. In Skye and other islands among the Hebrides, where it grows abundantly, the stems are applied to a variety of purposes, being made into ropes, mats, baskets, &c.; the ropes are valued especially by fishermen for their nets, on account of the length of time they last without rotting.

It is eaten by sheep; but cattle generally leave it untouched, or crop it only when compelled by hunger; or early in the spring before the flower-stems shoot up.

Genus 20. MELICA. Melic Grass.

Gen. Char. Inflorescence paniculate or racemose. Spikelets stalked, ovate, one- or two-flowered, with a stalked, club-shaped rudiment. Glumes two, nearly equal, blunt, three-veined, scarcely shorter than the enclosed flowers. Paleæ two; the lower one concave, rounded on the back, hardening around the upper and enclosing it with the ripening fruit.

The genus, containing between twenty and thirty species, is widely distributed. Few grasses are more elegant in habit; but their foliage is in general too scanty to render them of much value. Our two British species are not tenants of the pasture, growing only in woods, thickets, and other shady situations. Their seeds are comparatively large and have a sweetish flavour; hares and rabbits appear to be exceedingly fond of them, as in preserves, where the more common species, *M. uniflora*, grows abundantly, they are usually consumed before sufficiently ripe for shedding.

The generic name, bestowed by Linnæus, is borrowed from the Italian *melliga*, a term applied to the *Sorghum vulgare* or Millet, from the Latin *mel*, honey, on account of the honey-like sweetness of its stems.

The stalked club-shaped rudiment, mentioned in the above character, constitutes a marked feature of this genus: independent of its presence, the glumes of each spikelet, in our native species at least, contain only one or two perfect flowers. The *rudiment* springs from between the two flowers, or from the base of the inner glume, between it and the solitary flower, as represented in the magnified figures *b*, Plates XLIII. and XLIV. Dr. Withering has very correctly described the structure of its club-shaped apex in *M. uniflora*, as "composed of the rudiments of three or even four florets, each consisting of two membranaceous valves similar in shape to those of the perfect floret; each supported on a fruit-stalk of its own, rising from the base of the inner valve of the last rudiment; and each as small again as the floret below it. No stamens or pistils in any of them."

MELICA NUTANS. Mountain Melic Grass. PLATE XLIII.

Panicle slightly drooping, nearly simple, or like a raceme. Spikelets unilateral, distant, drooping; with two perfect flowers.

Melica nutans, *Linnæus*. *E. B.* 1059; ed. 2. 116. Generally adopted.

A native of rocky mountain woods, chiefly in the North of England. Stems slender, leafy, from a foot to eighteen inches high. Leaves narrow, acuminated, flat; the ligule short and obtuse. Inflorescence usually three or four inches long, the short branches all directed to one side, and almost constantly simple, hence constituting, strictly speaking, a unilateral raceme. Glumes ovate, convex, deep brownish purple with pale margins, three-veined, nearly as long as the included flowers. Paleæ cartilaginous, unequal, the larger outer one often tinged with purple. The club-shaped rudiment rises between the two flowers, and is shown attached at the base of the magnified one figured at *b*.

Perennial. Flowers in June and July.

Though a local, the Mountain Melic is not a rare grass, growing abundantly in many places in Yorkshire, Westmoreland, Cumberland, and, less frequently, in Scotland.

MELICA UNIFLORA. Wood Melic Grass. PLATE XLIV.

Panicle distantly branched, slightly drooping. Spikelets erect; with one perfect flower.

Melica uniflora, *Retz. E. B.* 1058; ed. 2. 115. Generally adopted.

Common in woods and under hedges, especially in hilly districts. Somewhat creeping at the lower part, rooting wherever the nodes come in contact with the soil. Flowering stems erect, slender, from one to two feet in height. Leaves much broader than those of *M. nutans*, flat, the ligule short, obtuse, with, occasionally, " a slender acuminate lobe on one side" (*Babington*). Panicle few-flowered, three to six or eight inches long; the branches distant, very slender, almost capillary. Glumes reddish purple, with pale margins.

Perennial. Flowers from May to July.

Genus 21. HOLCUS. Soft Grass.

GEN. CHAR. Inflorescence paniculate, spreading when in flower. Spikelets stalked, two-flowered; the flowers rather distant; the lower one perfect, awnless; the upper stameniferous only, with a long dorsal awn. Glumes two, nearly equal, membranaceous, keeled, longer than the flowers. Paleæ two, membranaceous, equal; the lower one awned in the imperfect flower. Fruit loosely invested by the dry paleæ.

The grasses included in this genus are in general very soft to the touch, in consequence of the downy covering of their leaves and inflorescence; hence the English name. They yield abundant foliage, but are so much disliked by cattle, that, even in overstocked pastures, the tufts of the more common British species often remain untouched, while every other leaf around them is closely cropped. Utility and plenty are not by any interpretation synonymous, and its recommendation on the latter plea is unsupported by any evidence as to the former. In this case at least, the herbage which our horses and oxen decline eating on the field, is equally ungrateful to their palates as hay, and hunger alone will induce them to feed upon that of which the Soft Grass constitutes any considerable proportion. The farmer would be justified in regarding all the members of the genus *Holcus* as weeds, and so far from admitting the seeds of either foreign or British species, in the mixtures advertised by their seedsmen, for laying down fresh pasture, they would act more wisely in endeavouring to eradicate the latter wherever they spring up spontaneously. *H. odoratus*?, *H. fragrans* of Pursh, a North American

grass, has been recommended here as an early-flowering species likely to prove advantageous; but Mr. Sinclair states that it is tender, the spring produce of herbage inconsiderable, and that its powerful creeping roots render it altogether unfit for agricultural purposes.

The generic name is altered from the Greek *olkos*, applied to some plant, a supposed grass, which was considered to have the property of extracting thorns from the flesh, and so termed from the verb *elko*, to draw out. The original signification has no immediate reference to the grasses before us.

The upper flower is very often perfect and fertile, especially in *H. mollis*, and the rudiment of the ovary is almost universally present, circumstances tending to show that its more frequent deficiency is the result of accident.

The copiously branched, variegated or silvery inflorescence, and broad, downy, almost silky foliage, render these conspicuous among our native grasses; few of which equal them in beauty.

HOLCUS MOLLIS. Creeping Soft Grass. PLATE XLV.

Panicle erect; its branches spreading when in flower. Upper glume somewhat acuminate. Awn of the upper flower knee-bent, rough throughout, extending beyond the glumes. Knots of the stem woolly. Creeping at the root.

Holcus mollis, *Linnæus*. *E. B.* 1170; ed. 2. 112. Generally adopted.

Not unfrequent, or even common, in woods and under hedges, to which situations it is usually confined; unless in light sandy soils, where it intrudes on the pastures and corn-fields, constituting in the latter one of the most troublesome weeds, and at the same time the most difficult to eradicate, in consequence of its rapid growth and widely creeping habit. Stems one to two feet high, conspicuously hairy or woolly at the joints. Leaves rather broad, soft to the touch, owing to the presence of a fine, but nearly invisible down; their sheaths more or less inflated. Panicle pale, pyramidal, rather distantly branched, two to five inches in length, and from an inch and a half to two inches or more in breadth at the base. Glumes nearly smooth, often tinged with purple; the upper one acuminated. Upper flower supported on a short stalk (see the magnified figure *b*), generally barren, containing stamens only with the imperfect rudiment of an ovary; bearing a sharply-bent awn on the back of the lower palea. Lower flower sometimes, but very rarely, awned.

Perennial. Flowers in July and August.

This is one of the grasses called *couch* and *wick*, *quicken* or *squitch*, in different parts of England. The creeping root-stems or stolones,

in light arable land, extend themselves rapidly in all directions round the parent plant to the distance of many feet: Mr. Sinclair has found them "five feet in length, the growth of a few months only," and remarks that, when once in possession of the soil, they cannot be expelled without great labour and expense; the best mode of doing so being to go over the field after ploughing, and collect them with the fork. Like the corresponding underground or surface-creeping stems of other grasses of similar habit, these troublesome stolones, or roots as they are commonly regarded, abound in nutritive matter, starch, sugar, &c.; and, though not apparently palatable to other animals constituting the well-fed stock of an English farm, pigs are exceedingly fond of them, turning up the soil in which they spread in their eagerness for the luscious repast.

HOLCUS LANATUS. Meadow Soft Grass. PLATE XLVI.

Panicle erect; spreading when in flower. Upper glume obtuse, with a small point or mucro. Awn of the upper flower curved inwards like a hook, not extended beyond the glumes, quite smooth except towards the tip. Knots of the stem nearly smooth. Not creeping.

Holcus lanatus, *Linnæus*. *E. B.* 1169; ed. 2. 111. Generally adopted.

Common in meadows and pastures, and little less so in woods and thickets. It forms tufts springing from a fibrous root, and though the stems are sometimes decumbent at the lower part, they exhibit no tendency to the creeping habit which so strikingly characterizes *H. mollis*. The height varies from a span to one or two feet; and the joints, though not devoid of pubesence, have not the peculiar woolly or downy tufts by which those of the last species are ordinarily distinguished. Independent of this, however, the whole plant is more decidedly hairy, which renders the hue of both leaves and stem pale or whitish green, and bestows upon them a velvet-like softness to the touch, while a similar character extends to the inflorescence, the glumes especially being covered with a short down. Leaves usually broader than those of the Creeping Soft Grass, and, perhaps, feeling rather rougher when passed through the hand, in a direction opposite to the inclination of their hairy covering. Sheaths inflated. Panicle dense, owing to the number and repeated division of its branches and branchlets; two to six inches in length, and from an inch and a half to three inches or more in breadth; pale green, but often beautifully variegated with white and pinkish purple. Upper glume terminated abruptly, but with a projecting point or mucro at its apex. Both of the flowers are supported upon very short stalks, but the upper one is not

much elevated beyond the lower, and its awn is curved in a peculiar manner, so as to have been compared by some botanists to a fish-hook (see magnified figure *b*): this flower is usually, but not universally barren.

Perennial. Flowers in June and July.

The general distribution of this grass in old or long unbroken pastures and upon almost every kind of soil, has probably led many persons to entertain higher notions of its value than careful investigation will substantiate; at the same time it yields largely to the scythe, and where abundant and luxuriant, as it often is on moist peaty lands, wonderfully increases the bulk of the hay crop; such hay, however, is soft and spongy, and, as experience manifests, neither agreeable nor wholesome fodder, for horses especially. Mr. Sinclair recommends, where this species predominates, sprinkling the hay with salt when it is carried, which would render it more palatable. In its more favourite habitats, the abundant production of seed, and broader foliage, soon enable it to overpower and destroy the more slender and less prolific grasses; hence advantage should be taken of its first appearance to eradicate it from the soil, before a few scattered tufts have had time to multiply into hundreds and thousands.

Genus 22. ARRHENATHERUM. Oat-like Grass.

GEN. CHAR. Inflorescence loosely paniculate. Spikelets stalked, two-flowered. Lower flower stameniferous only, with a long dorsal knee-bent and twisted awn inserted above the base of the lower palea: upper one perfect, with a short straight awn inserted near the apex of the lower palea. Glumes two, membranaceous; the upper one longer and equalling the flowers. Paleæ two, herbaceous, terminating in two points.

This genus was founded by Palisot de Beauvois upon a single species, which has been variously distributed by different botanists. Linnæus arranged it under *Avena*, the Oat family, to which it appears most nearly allied.

The name is derived from the Greek *arren*, male, and *ather*, an awn or point, in allusion to the conspicuous awn of the lower barren flower; like many others, belonging to botanical phraseology, its value rests rather upon its being a name, than on euphony or peculiar adaptation to generic character.

ARRHENATHERUM AVENACEUM. Common Oat-like Grass. PLATE XLVII.

The character of the species is that of the genus, of which it appears to be a solitary representative.

Arrhenatherum avenaceum, *Beauvois. Lindley. E. B.* ed. 2. 113. Generally adopted by modern botanists. Holcus avenaceus, *Scopoli. E. B.* 813. *Loudon, Encycl.* 860. Avena elatior, *Linnæus.*

One of the commoner British grasses, growing in most soils and situations, but generally preferring the skirts of woods and thickets, hedges, and other sheltered places, where its flowering-stems often attain the height of three feet or more. It is, however, not unfrequent in meadows and open pastures. The roots are fibrous, but the lowermost joints of the stems, near the ground, often enlarge in the form of small bulbs or tubers; and, in dry soils especially, this peculiarity occasionally becomes so strikingly developed, that, associated with a slight corresponding difference in habit, it has been regarded significant of a separate species, *A. bulbosum* of Lindley and others. In luxuriant specimens the panicle is sometimes more than a foot in length, but in exposed situations not above six inches, or even shorter; the slender, nearly verticillate branches expand when in flower, but ultimately close upward against the rachis. Spikelets few, pale green, the bases of the glumes more or less tinted with brown. The structure of the two flowers, and the absence of stigmas in the lower one, together with the characters of the glumes and paleæ, and the difference between the awns of the latter in the barren and fertile flowers, are features of the genus illustrated in the magnified figures.

Perennial. Flowers in June and July.

The habit or general aspect of this grass is more accordant with that of an Oat than of one of the Soft Grasses, but in the structure of the spikelets it more nearly resembles the latter, differing chiefly in the position of the barren flower, a feature which I have never found reversed.

The herbage is very productive, and, when growing in natural or permanent pastures among other grasses, cattle and sheep eat it promiscuously, though it has been affirmed that they decline it alone, and dislike hay in which it may be present in any large proportion. Sinclair's remarks upon it are rather contradictory, but certainly very little in favour of its agricultural capabilities. After mentioning the fact of its rapidity of growth, and the early and plentiful supply of herbage which it yields in spring, properties that would entitle it to a high rank among the grasses adapted for alternate husbandry, he adds that it contains too large a proportion of bitter extractive and saline matters to warrant its cultivation, without a considerable admixture of other kinds. To me it appears that a grass so circumstanced is unworthy of the farmer's attention, especially when associated with a habit that renders its introduction in alternate cropping highly unsatisfactory, namely the difficulty of extirpation when no longer wanted. In accordance

with this habit it constitutes one of the many species known as *couch grasses*, as well as by other provincial appellations already noticed in our work. In some of the northern counties it is called "knot-grass," and a Yorkshire farmer calls it "the vilest of all light-land *wickens*." The tendency which it has, in light soils, to form small bulbs or tubers, is the cause of this execration. A very intelligent correspondent of the "Farmer's Magazine," June 1855, in his paper on the "classification and extirpation of weeds," observes that "no weed is more troublesome to the farmer than this on the better turnip soils, and on the more loamy clay fallows. The root is perennial, and composed of knobs or bulbs that are joined together at distances by intervening threads, and from each bulb shoots proceed, which circumstance renders the extirpation of the weed exceedingly difficult and tedious."—"The roots are very tenacious of life, and no degree of arid exposure will destroy the vital principle. Decomposition in a heap, along with other earthy matters, requires to be very minutely inspected at each turning over of the heap; for some roots are very apt to escape on the outside of the compost, and which, being carried to the land, will immediately grow, and multiply very fast. Even the burning of the roots in heaps on the field is not thoroughly safe; for the outside may escape ignition, and grow as before. The most effectual method is to carry the roots from the field at once, and to lay them in some waste corner, where they may be burned at leisure." This extract may serve to caution the amateur or even the practical farmer against the admission, knowingly, of the seeds of the grass before us among those selected by seedsmen and printed in their catalogues, as insuring copious crops, and adapted for artificial pasture. Nature has distributed it widely, and so long as it has to struggle for existence with other self-established tenants of the soil, it is harmless, and probably beneficial to the animals feeding upon the mingled herbage, among which it is an admitted but never a predominant associate. On the down, and the heath, and the common, its ill qualities are all either counterbalanced or restricted; it is only when the ground is broken up, and the pasture converted into arable land, that the mischief commences; then, its bulb-forming habit and tenacity of life come into action, and, resisting the destructive processes to which its less enduring brethren have yielded, it becomes one of the worst of weeds.

Dogs eat the leaves to excite vomiting, in the same manner as they do those of *Triticum repens*.

Genus 23. HIEROCHLOE. Holy Grass.

Gen. Char. Inflorescence paniculate. Spikelets stalked, three-flowered. The two lower or lateral flowers stameniferous only

and triandrous; the uppermost or central one perfect, diandrous. Glumes two, nearly equal, membranaceous, as long as the flowers. Paleæ two; upper one of the barren flowers two-veined, that of the fertile flower one-veined; lower ones cartilaginous, permanent.

A genus of confined but uncertain limits, the species of which are distributed over the colder regions of both hemispheres. They were originally regarded as appertaining to *Holcus*, resembling the grasses of that genus in general aspect and imperfectly developed spikelets, while they differ in the number of flowers associated in the latter being three instead of two.

The name was bestowed by Gmelin on *Hierochloe borealis*, which, being sweet-scented, is, in some parts of Prussia, strewed about the entrances and pavements of the churches on festival days. The English title is a translation from the Greek *hieros*, holy, and *chloe*, grass.

HIEROCHLOE BOREALIS. Northern Holy Grass. PLATE XLVIII.

Panicle erect, spreading, with smooth branches. Flowers awnless. Outer palea ciliated on the margins. Leaves flat. Creeping at the root.

Hierochloe borealis, *Roemer et Schultes. E. B. Supp.* 2641. *E. B.* ed. 2. 113*. Generally adopted by modern botanists. Poa 53, *Linnæus, Fl. Lapp.* Holcus odoratus, *Linnæus, Fl. Suec.* H. borealis, *Schrader.* H. repens, *Host.*

First recognized as a native of Britain in 1812, by the late Mr. G. Don, who discovered it growing in a narrow mountain valley, Glen Kella, in Forfarshire. It has since been met with in two or three other places in Scotland, but may still be regarded as one of our botanical rarities. Creeping rather widely at the root, it sends up straight, smooth stems about a foot in height. Leaves rough on the margins. Panicle reddish brown, glossy. Spikelets ovate. Flowers scarcely extending beyond the glumes. Central fertile flower smaller than the external barren ones.

Perennial. Flowers in July.

The odour of the plant nearly resembles that of *Anthoxanthum odoratum*, but is more powerful, especially when it is dried. Sir W. J. Hooker mentions that in Iceland, where it grows very plentifully, the people employ it for scenting their apartments and clothes. In Prussia this grass was dedicated to the Virgin Mary, hence Loesel named it Gramen Mariæ Borussorum.

Genus 24. KOELERIA.

Gen. Char. Inflorescence rather densely paniculate. Spikelets nearly sessile, laterally compressed, few-flowered. Glumes two, unequal, membranaceous, keeled, shorter than the flowers. Paleæ two, membranaceous, naked at the base; the lower one keeled, sharply pointed or with a straight subterminal bristle. Fruit free.

A small genus, but widely distributed, chiefly over the northern hemisphere. In structural affinity it is nearer to *Poa* than to *Aira*, under which latter the only British species was formerly arranged. They are grasses of little value, many of them being only annuals, while the foliage of others is too scanty to afford much food.

Named by Persoon, in honour of George Louis Koeler, of Mayence, author of a work on German and French Grasses, published in 1802.

Koeleria cristata. Crested Koeleria. Plate XLIX.

Panicle erect, interruptedly spicate. Spikelets with two or more perfect flowers. Lower palea acute, three-veined. Leaves narrow, hairy or ciliated on the margins.

Koeleria cristata, *Persoon*. Most modern botanists. Aira cristata, *Smith*. *E. B.* 648; ed. 2. 103. Airochloa, *Link*, *Lindley*, *Parnell*.

This is far from being a rare grass, though its partiality to calcareous soils and dry situations renders it local in distribution. On the upland pastures of North Britain it is often met with in abundance, especially, as remarked by Sir W. J. Hooker, in the vicinity of the sea. Old walls and ruinous buildings are not unfrequently decorated with its silvery-grey inflorescence. In very dry exposed habitats it seldom attains a height exceeding six or eight inches, the stem rising from a tuft of pale, short, slender, convolute, radical leaves; but in moister and more sheltered situations it is sometimes much more luxuriant, the leaves expanding, though still narrow, and nearly equalling the stem in its increased length of a foot or more. The cylindrical spike-like panicles vary in length from one to two or even three inches, and are liable to differ greatly in appearance, as do the leaves likewise, owing to their being more or less downy or glabrous. The keel of the glumes, especially that of the outer one, is finely toothed or ciliated.

Perennial. Flowers in June and July

Genus 25. SESLERIA. Moor Grass.

GEN. CHAR. Inflorescence compact, spike-like. Spikelets nearly sessile, laterally compressed, with two or more perfect flowers. Glumes two, nearly equal, pointed, as long as the flowers. Paleæ two, naked at the base, membranaceous, nearly equal; the lower one keeled, jagged at the end with three or five points, the central one of which, an extension of the keel-vein, is longest. Styles united to about the middle. Stigmas long, filiform, papillose. Fruit free.

A small genus of perennial European Grasses. They were originally referred to *Cynosurus*, but appear to have little affinity with that or any other genus. The presence of a glume-like bract at the base of the spikelets is characteristic of most of the species.

The name was bestowed by Scopoli in commemoration of Leonard Sesler, an Italian physician and botanist of the eighteenth century.

SESLERIA CÆRULEA. Blue Moor Grass. PLATE L.

Inflorescence spicate, ovate or oblong, slightly unilateral, bracteate at the base. Bracteæ alternate. Spikelets imbricated. Lower palea ending in four teeth; its mid-vein rough, and extending beyond it as a short mucro or bristle. Leaves abrupt, terminating in a minute rough point.

Sesleria cærulea, *Scopoli*. *E. B.* 1613; ed. 2. 118. Generally adopted. Cynosurus cæruleus, *Linnæus*.

Not uncommon and often abundant on the mountain moors and pastures of the north of England, and in Scotland and Ireland; especially in limestone districts, where it is one of the most frequent species that vegetate in the clefts of the rocks. The roots descend very deeply into the soil, ramifying into every crevice of the stone on which it rests, and thus secure the widely spreading but compact tufts of the Grass from being washed or blown away from their exposed habitats. Stems six inches to a foot high, scarcely exceeding the foliage; sometimes described as being without joints, though one or two of the latter will generally be found near the base on close inspection. Leaves comparatively broad, linear, obtuse, but with a minute rough point at the apex, pale glaucous green. Spike from half an inch to an inch in length, bluish grey or silvery. Spikelets in pairs, one sessile, the other shortly stalked, oblong; the lower ones especially have an ovate or ovate-lanceolate, ciliated and toothed bractea at the base, as exhibited in one of our magnified figures. Glumes broadly lanceolate, three-toothed, the middle one lengthened into

a point, and sometimes bifid; keel and margins hairy. Flowers generally exceeding the glumes in length. Lower palea ciliated, jagged and toothed; the teeth usually five, including the prolongation of the mid-vein, which is more or less extended beyond the apex: upper palea bifid at the extremity. Stigmas very long, linear.

Perennial. Flowers in April, or, in very elevated situations, in May or June, and frequently again in September.

A very beautiful Grass, and well deserving of a place in the alpine garden or among rock-work, situations in which its bluish shining spikes, and large, orange-yellow anthers tipped with purple, are among the earliest indications of approaching summer. It is, however, only under full exposure to sun and wind that the blue hue of the inflorescence becomes at all a predominant feature.

It is the most productive in foliage of all the alpine Grasses, and, though distasteful to cattle generally, sheep will often climb in search of it rocks so precipitous as to appear all but inaccessible; a circumstance not a little surprising when the extreme rigidity of the leaves is considered, added to the fact that their margins and mid-vein are furnished with siliceous serratures pointing upward, like the teeth of a fine saw, and so sharp as to cut the hand deeply when drawn through it in an opposite direction.

Sesleria cærulea has at first sight, perhaps, somewhat the aspect of a *Carex*; and when the rigid texture and jointless stem are observed, a novice in Grass examination would be liable to regard it as such, especially when, on further inspection, the leaf-sheaths appear entire and the presence of the ligule equivocal. The tubular character of the stem, however, which is not triangular, the existence of at least one joint at its base, and, above all, the structure of the flowers, will determine the question. To the professed botanist, who may turn over our pages rather critically than with the view of deriving benefit from the consultation, these remarks may appear superfluous; but, as *Carex ovalis* was given last May to a pupil of mine by a Fellow of a certain learned Society, as a specimen of the Grass before us, the persevering student will better appreciate their intended application.

Genus 26. PANICUM. ECHINOCHLOA. Panick Grass.

Gen. Char. Inflorescence paniculate; branches spike-like, unilateral in the mass and in each part. Spikelets all on one side of the flattened partial rachis, two-flowered, the lower flower imperfect. Glumes two; the lower one small, three-veined; the upper as long as the spikelet, five-veined, mucronate or awned. Lower palea of the imperfect flower

resembling and equalling the upper glume; upper membranaceous or wanting. Paleæ of the fertile flower two, equal, cartilaginous; permanent; investing, but scarcely cohering to, the ripe fruit.

The original genus *Panicum*, so named from the Latin *panis*, bread, on account of the foodful quality of the seeds of certain species, has been much curtailed and broken up by modern botanists, the solitary British species here retained being itself the type of one of the more recently established genera, *Echinochloa*. The number of species of *Panicum* as formerly estimated, upwards of two hundred, renders any available character of separation deserving of our notice; but, however generally adopted, those now in use are, with very slight exception, far from being satisfactory.

The Panick Grasses have an exceedingly wide distribution, but are chiefly met with among the natural vegetation of warm and especially of tropical countries, where, in many districts, they constitute the chief support of herbivorous animals, being the true pasture grasses of the land. Several of the species thus subservient attain the height of from six to ten or twelve feet, the herbage being equally "tender and delicate" with that of our English meadows. One species, *P. arborescens*, is among the tallest of the Grass family, contending for elevation with the loftiest trees of the forests of Hindustan, through the branches of which its slender stems, scarcely thicker than a goose-quill, penetrate, until they are seen towering above their summits.

Notwithstanding the small, in some instances even diminutive size of the grain in these Grasses, several of them have been objects of agriculture among the Eastern nations from time immemorial. Of these *P. miliaceum* is the best known, from the long cultivation of its two varieties, Brown and Yellow Millet, in southern Europe; it is the *cheena* of the Hindus, by whom *P. miliare* and *P. frumentaceum* are likewise grown, as food for the poorer classes, in dry and elevated lands,—the latter, called *shama* and *sanwuk*, being esteemed one of the most wholesome and nutritious kinds of grain.

In England the Millets are seldom used except for feeding poultry.

PANICUM (ECHINOCHLOA) CRUS-GALLI. Loose Panick Grass. PLATE LI.

Panicle erect; its branches alternate, unilateral, more or less adpressed to the angular common rachis. Spikelets ovate, turgid, hispid, subunilateral. Lower glume very short, between heart-shape and ovate, mucronate; upper one ovate-acuminate, five-veined, hispid. Barren flower with two paleæ, the lower one large, and terminating in a more or less elongated bristle-like point.

Panicum Crus-galli, *Linnæus. E. B.* 876; ed. 2. 102. *Hooker & Arnott.* Echinochloa Crus-galli, *Palisot de Beauvois, Lindley, Babington.* Oplismenus Crus-galli, *Kunth.*

Occasionally met with on moist arable land and waste ground in the southern and eastern counties of England, chiefly in the vicinity of tidal rivers and about garden grounds, as around Battersea, Deptford and Greenwich near London; Petersfield, Hampshire; and about Norwich and Thetford, Norfolk. It is evidently not indigenous, but, introduced with garden seeds, or floated hither from the Continent, vegetates from seed, in any favourable situation, for a few years, and then disappears until renewed by a fresh importation. The natural production of a warmer climate, few of its seeds seem to mature under garden culture here; and, while different species of exotic annuals spring up spontaneously from year to year, like those of indigenous growth, *P. Crus-galli* can never be depended upon as a self-renewer. A strong coarse-looking Grass, forming compact tufts of foliage, from which the stems, at first decumbent, rise to the height of one or two feet. Leaves broad, linear-acuminate, often destitute, or nearly so, of ligule. Panicle three to six inches long, when short more or less compact and pyramidal, but generally conspicuously branched; lower branches one to two inches in length, and distant, the upper ones becoming gradually shorter and at length, confounded in a terminal spike; dark green or tinged with purple. It is an exceedingly variable grass; and the identification of the alleged naturalized species under this name is doubtful, two, at least, having been associated with it by English collectors.

Annual. Flowers in July and August.

As a weed it is naturalized over most parts of Europe, especially in the south; it appears under the same character in North America; and I have seen it this summer in a collection of dried specimens from South Australia. Its native country is doubtful; but it has probably emanated from northern India, where it is still found wild with *P. Crus-corvi* and others of its congeners.

Genus 27. SETARIA. Bristle Grass.

Gen. Char. Inflorescence spike-like, or more or less distinctly branched. Spikelets compressed, single or two or three together, surrounded by an involucre of bristles, two-flowered, the lower flower imperfect. Glumes two, awnless; the lower one smaller, three-veined; the upper as long as the spikelet, many-veined. Lower palea of the imperfect flower resembling and equalling the upper glume; upper often wanting. Paleæ

of the fertile flower two, the outer larger, cartilaginous; investing the ripe fruit.

Separated from *Panicum* by Palisot de Beauvois, and now generally adopted by British botanists as a distinct genus; differing from the latter chiefly in the more compact form of the inflorescence, and in the presence of bristles at the base of the spikelets. These bristles remain attached to the rachis after the spikelets have fallen; and the generic name, from the Latin *seta*, a bristle, is derived from this circumstance. The species, about thirty in number, are annual plants indigenous to tropical and warm climates, where several are cultivated for their seeds as a substitute for Millet. *Setaria Italica* and *S. Germanica*, Italian and German Millets, so termed from being first known to botanists as grasses of economical culture in central and southern Europe, are among these, and were originally brought from India. *S. Germanica* is largely grown in Hungary as food for horses, being preferred for such purpose beyond all other grasses. In England the genus is little known, the two or three naturalized species being only very locally distributed, and regarded by the farmer as weeds. An objection to them in an agricultural point of view is the lateness of their appearance; but the foliage is succulent and abundantly produced until very late in the autumn, with an equally profuse succession of rapidly maturing and nutritious seeds, that are a favourite food of most seed-eating birds, especially those of *S. viridis*.

SETARIA VERTICILLATA. Rough Bristle Grass. PLATE LII.

Inflorescence interruptedly spicate, cylindrical, with whorled branches. Bristles of the involucre rough, with declining teeth. Lower, barren flower with a single palea. Outer palea of the fruit nearly smooth.

Setaria verticillata, *Beauvois*. Most modern botanists. Panicum verticillatum, *Linnæus*. *E. B.* 874; ed. 2. 100.

Not unfrequent as a weed in and about arable- and garden-ground in the vicinity of London and Norwich, but of rare occurrence elsewhere. Stems decumbent at first, a foot and a half to two feet high, smooth, except just below the spike, where it is angular and rough, slender. Spike-like inflorescence two to four inches long; not always presenting the interrupted or divided appearance arising from its branched composition, dark green or purplish. Occasionally one or two of the lowermost series of branches become separated from those above by the extension of the rachis between them, rendering the interrupted character more prominent. Spikelet clusters shortly stalked. Involucral bristles

seldom more than one or two, possibly abortive spikelets, rough with stiff hairs or teeth pointing downwards, which cling to the hand or fingers as the spike is drawn downwards through them; hence the English name.

Annual. Flowers in July, and thence often to the end of the year.

A common Grass in many parts of southern Europe, but scarcely naturalized in England, owing its introduction thither to accidental admixture of its seeds with those imported for agricultural and gardening purposes.

SETARIA VIRIDIS. Green Bristle Grass. PLATE LIII.

Inflorescence spicate, continuous, cylindrical. Bristles of the involucre rough with erect teeth. Lower, barren flower with a single palea. Outer palea of the fruit nearly smooth.

Setaria viridis, *Beauvois.* Most modern botanists. Panicum viride, *Linnæus.* *E. B.* 875; ed. 2. 101.

Found in similar habitats to the preceding species, which, indeed, it often accompanies about London and Norwich; but it is much more distributed as to locality and station, though hitherto almost exclusively confined to the south-eastern counties of England. Stems one to two feet in height, smooth throughout, more generally erect than those of *S. verticillata,* the leaves being at the same time broader and more succulent than in that species. Spike two or three inches long, perfectly continuous, cylindrical, bluntly attenuated at the apex, pale green or yellowish. Involucral bristles many, rough, with minute teeth projecting at right angles or upwards, brown or reddish.

Annual. Flowers in July, and until the end of autumn.

This would be a valuable grass to sow in game preserves and warrens, hares and rabbits feeding upon it with avidity. It will flourish in the driest and poorest of light soils, indeed in almost any medium, water and shifting sand excepted. The comparatively large seeds are easily collected; and few plants are so prolific, a single specimen in the garden having yielded 127 spikes during the season.

SETARIA GLAUCA. Glaucous Bristle Grass. PLATE LIV.

Inflorescence spicate, continuous, cylindrical. Bristles of the involucre rough with ascending teeth. Lower, barren flower triandrous with two paleæ. Outer palea of the fruit transversely wrinkled.

Setaria glauca, *Beauvois.* Most modern botanists. Panicum glaucum, *Linnæus.*

First observed as a naturalized species by Mr. Borrer, about Weybridge, Surrey; since found near Hoddesdon, Hertfordshire, and Swanscombe, Kent. Stems ascending at first, afterwards erect, a foot and a half to two feet in height, more or less angular immediately below the inflorescence. Leaves bearded at the base. Spike about two inches long, generally compact and strictly cylindrical, pale. Spikelets usually two together. Involucral bristles many, rigid, rough, with minute teeth projecting upwards. Lower flower with three stamens and two paleæ.

Annual. Flowers in September.

Undoubtedly a distinct species, though liable to be passed over as one of the preceding, of which perhaps it more nearly resembles *S. verticillata*. The generally paler and more or less glaucous or whitish-green hue, of the foliage especially, is however a striking feature.

S. glauca appears, from its comparatively recent discovery and more local distribution, to be a later importation than its two congeners, and at the same time less adapted to the climate of this country. Its later flowering, indicating derivation from a lower latitude, is much against naturalization in England. It is, however, a frequent and abundant weed in arable land throughout Southern Europe, though no more strictly indigenous to the countries of the latter than to our own.

The English botanist ought to be prepared to meet with other species of this genus as occasional visitants, introduced, as they frequently are, with corn and other agricultural seeds from the Continent and elsewhere. In this way, and by chance distribution from our gardens, *S. Italica*, and even *S. Germanica* and two or three more, will, probably within a few years, have an equal, if not a superior, claim to rank in our British Flora, to that under which *S. glauca* is now admitted.

The three species above described have long since been carried across the Atlantic, and become equally naturalized productions of the United States of America as they are of Europe.

Genus 28. POA. Meadow Grass.

GEN. CHAR. Inflorescence paniculate, generally loose and spreading. Spikelets stalked, two- or many-flowered. Glumes two, obtuse, more or less unequal, shorter than the flowers. Paleæ two, membranaceous, obtuse; the lower one three or five-veined, keeled, compressed, scarious at the apex; the upper one usually notched at the apex.

The genus, as originally constituted, is one of great numerical extent, containing about a hundred and fifty species, and distributed

over almost every part of the world. The above character, however, applies strictly to one portion of the group, which some modern botanists have separated into two or more genera. These latter are adopted in the present work, as the divisions, though far from being precise as to their limits on the broad scale, are so far valuable to the home student, that, by directing his attention to a comparatively small number of species under each generic type, they relieve the tedium of comparison with many. Actuated by a laudable desire to simplify as much as possible the classification of the tribe, many of our best practical botanists retain the genus *Poa* entire; even while admitting that its division by others is founded upon characters equally important and valuable as those constituting the leading differential ones of genera universally admitted.

Named from the Greek *poē*, applied to pasture or herbage in common, and well adapted to a genus of Grasses which, throughout Europe especially, forms the basis of most natural meadows.

The species of *Poa* proper are generally characterized by their tender succulent stems and foliage, of which most cattle are fond; hence the more productive kinds usually form a portion of all artificial pastures, though varied according to the quality of the soil and situation, and the experience or caprice of the cultivator. *Poa Abyssinica*, an annual species, is cultivated for the sake of its seeds, used for making the *teff* bread of the Abyssinians, the poorer classes among whom rarely eat any other: in preparing it, the dough is leavened by being allowed to turn sour, and is then made into circular cakes for baking. These cakes are white and spongy, and are described as having a hot, disagreeable, sourish flavour; they are, however, considered very nutritive and easy of digestion: toasted brown, and infused in water, they furnish a liquor called *bouza*, the common drink of the country.

Of the thirteen Grasses figured in this work under the genus *Poa*, several are unquestionably only varieties or hybrids; but so uncertain at present are our rules for specific distinction among the plants before us, that it is difficult to determine the limits of true species, of which it seems probable that the British Flora does not actually contain more than five or six at the utmost, namely *P. annua*, *P. alpina*, *P. nemoralis*, *P. trivialis*, *P. pratensis*, and perhaps, as a naturalized continental intruder on our coasts, *P. bulbosa*; this latter, however, notwithstanding the peculiarity of its habit and webbed flowers, occupies a very equivocal position apart from *P. alpina*.

The arrangement of the *quasi* species is adopted, with slight verbal alteration, from Mr. Babington's 'Manual of British Botany,' not only with the view of rendering them more readily recognizable to the student, but because the several sections appear

to me, with all due deference to my learned compeers, to mark the confines of those which may be regarded as true ones.

* *Root fibrous, annual; not stoloniferous. Panicle branches solitary or in pairs.*

POA ANNUA. Annual Meadow Grass. PLATE LV.

Panicle erect, widely spreading, with a triangular outline. Spikelets oblong-ovate, five- or six-flowered; flowers rather distant, free (not connected by a web). Lower palea with five veins, all more or less silky. Stems compressed. Upper leaf much shorter than its sheath; ligule oblong, acute.

Poa annua, *Linnæus. E. B.* 1141; ed. 2. 131. Generally adopted.

The most common and universally distributed of all our Grasses, growing in all soils and situations throughout the kingdom. Stems varying from an inch to eight or ten inches in height, generally more or less prostrate at the lower part, and throwing roots from those joints which lie in contact with the soil. Leaves flat, rather obtuse, broad, flaccid, often wavy, very bright green; the uppermost always short, with a very long sheath, usually inflated towards the upper part. Inflorescence very loosely spreading, an inch and a half to three inches long; the branches slender, gradually shortening upwards so as to render the panicle triangular. Spikelets pointing to one side, three- to six-flowered, rarely more. Glumes unequal, obtuse, ovate-lanceolate, three-veined. Lower palea ovate-lanceolate, rather acute, diaphanous at the margins, five-veined; the veins minutely silky. The magnified figure *a* shows the many-flowered spikelet; *b*, a single flower with its dissimilar paleæ and the diaphanous margin of the outer one.

Annual; springing up, flowering, and ripening its seeds throughout the year, unless during the prevalence of frost.

Although named and described *annual*, and although, as observed by Mr. Bentham, "it will often germinate, flower, ripen, and shed its seeds and die away in the course of a few weeks," this grass in certain situations assumes somewhat the character of a perennial, in consequence of the lateral rooting of its partially-decumbent stems, the bases of which remain and form new tufts around the old one; this modification of its general habit may be observed on well-kept lawns, frequently mown and rolled, or on the borders of footpaths where it is liable to be trodden upon from time to time; but in no instances do we see any tendency to the extension of creeping branches or stolones from the bases of the stems.

Poa annua is not a grass of much agricultural importance, as, although greatly relished by cattle and among the most nutritious

of its family, its produce is too small to yield other than a very scanty crop in hay; hence, under the rotation system, many practical farmers consider it little better than a weed, and, as such, would exclude it altogether from the list of economical species recommended for laying down new meadows. Another objection that has been urged is "that, although a dwarf plant, it has large spreading roots, and is so prolific, by spreading its abundant seeds in every direction the same year that it is sown, that it is seldom that a bare space of ground is not quickly occupied by it, to the exclusion or detriment of more productive and better grasses." Observation will satisfy any one interested in grass lands that such objections are altogether unimportant, as, so far from displacing the more productive grasses, it is itself soon overpowered by them, unless in situations where frequent treading assists it in establishing dominion over them: such is the case in many of the park and square inclosures in and about the metropolis and other large towns, where this grass sometimes constitutes the chief portion of the green sward,—while in the open and less-frequented meadow and pasture it will probably only be noticed about the footpaths and roads by which they are traversed. It is a troublesome and persevering weed in gardens, especially on gravel walks, from which it can only be successfully eradicated by careful and frequent removal as soon as it appears: a very customary remedy is to strew salt over it during damp weather, renewing the application from time to time until the grass is destroyed, by which period the box-edgings and not a few valuable border plants will probably have disappeared likewise.

The Annual Meadow Grass is a vegetable colonist, indigenous to the whole of the northern hemisphere, its tropical regions scarcely forming any exception,—while it seems to have followed European cultivation wherever that has been extended into the southern.

It is sometimes called Suffolk Grass by the older writers.

** *Root fibrous, perennial; not stoloniferous. Lower panicle branches solitary or in pairs. Dorsal and marginal veins of the lower palea hairy or silky.*

Poa bulbosa. Bulbous Meadow Grass. Plate LVI.

Panicle erect, more or less compact. Spikelets ovate, three- or four-flowered; flowers connected by a web. Lower palea with three silky veins. Stems swollen or bulb-like at the base. Leaves with a narrow, white, cartilaginous, serrated margin. Upper leaf much shorter than its sheath; ligule prominent, acute.

Poa bulbosa, *Linnæus. E. B.* 1071; ed. 2. 128. Generally adopted.

This is a very local species in England, being almost exclusively

found on the sandy sea-shores of our eastern and southern counties, though occasionally occurring inland on dry sandy ground, upon which alone it seems calculated to vegetate. It grows in great abundance on the Denes at Yarmouth, where it constitutes, perhaps, the predominant vegetation. The root is tufted and fibrous, resembling that of an annual grass; but the bases of the stems and leafy offsets form a cluster of oval or rounded bulb-like bodies, which, separating eventually as the foliage withers, or after the flowering season has passed, are drifted in all directions by the wind, and appear to be the chief source of its propagation. Stems erect, six or eight inches in height; usually bearing two, or at most three very short leaves with long sheaths, the uppermost of which originates below the middle of the stem. Ligule of the upper leaves generally very prominent, and terminating acutely. Panicle often so compact as to appear spike-like, from an inch to an inch and a half in length. Spikelets compact, three- or four-flowered. Glumes nearly equal, three-veined. Flowers copiously webbed at the base. Lower palea usually five-veined; the dorsal and marginal veins conspicuous and silky, the intermediate ones obscure, smooth. See the magnified figures: *a*, the spikelet; *b*, a separated flower with its webbed base.

Perennial. Flowers in April and May.

Cattle are fond of it as spring pasture; but the produce is too small and transitory to render it of much value as food. During the greater part of the summer, the bulbs, which have been compared to little onions, remain inactive, and are blown about at random. With the setting-in of the autumnal rains they vegetate, fixing themselves to the sandy soil by long downy radicles, throwing up thick tufts of leaves, that wither after the production of a new crop of their viviparous offspring and the ripening of the seeds.

This habit is so striking and peculiar as to confirm the opinion generally entertained by botanists, that the plant before us is one of the most distinctly marked species of its genus,—a fact to which I cannot myself subscribe, deeming it merely an altered form of *P. alpina*, a grass liable to considerable variation in development, and capable of accommodating itself to circumstances that involve no ordinary degree of metamorphosis in general appearance. This conviction on my part has not at all interfered in biasing the above description, as will appear by comparison with those given in other works. See further remarks upon the subject under *P. alpina* and at the close of this section. *P. bulbosa* is widely distributed over the continent of Europe, especially in the more temperate and warmer regions; and, judging from its local or, rather, limited disposition in England, and apparent total absence from Scotland and Ireland, is probably a naturalized wanderer on

our sea-coasts, arriving thither from warmer shores, instead of descending from its surmised relative so plentifully distributed on the British mountains.

Poa laxa. Wavy Meadow Grass. Plate LVII.

Panicle slightly drooping, more or less compact. Spikelets oblong-ovate, three- or four-flowered; flowers acute, connected by a web. Lower palea five-veined; the dorsal and marginal veins silky. Upper leaf folded and slightly incurved, but tapering, much shorter than its sheath; its ligule long and acute.

Poa laxa, *Haenke. Lindley. Hooker and Arnott.* Poa minor, *Gaudin. Babington.* P. flexuosa, *E. B.* 1123; ed. 2. 127.

A native of the higher mountains of Scotland, where it was first observed by Mr. J. Mackay, who gathered it on Ben Nevis, and afterwards found by Mr. G. Don, Dr. Graham, and others on Loch-na-Gar and the Clova Mountains. Tufted or very slightly creeping, more or less glaucous. Stems slender, weak, six inches to a foot in height. Leaves flat, linear, acuminated, more numerous and narrower than those of the ordinary *P. alpina.* Panicle rather loose, though occasionally somewhat compact, scarcely drooping at the upper part, one to two inches long. Spikelets with about three flowers; the glumes more pointed than in most plants of this genus. Flowers webbed at the base. Lower palea five-veined; the dorsal and marginal veins silky, the intermediate ones smooth and indistinct.

Perennial. Flowers in July and August.

Poa minor. Lesser Mountain Meadow Grass.

Panicle slightly drooping. Spikelets oblong-ovate, three- or four-flowered; flowers free (unconnected by a web). Lower palea with three silky veins (no intermediate ones). Upper leaf flat and taper-pointed. Ligules all long, acute.

Poa laxa, *Babington. Parnell. Bentham.* P. laxa *β*, *Hooker and Arnott.*

Found in the same habitats as the preceding, from which, indeed, it is not easily distinguishable, unless by the flowers not being webbed,—a feature of very equivocal importance, as instances occur of its occasional deficiency in some of the flowers of a spikelet while others possess it, in those grasses of which its presence is assumed to be a leading characteristic.

In the 'British Flora' of Messrs. Hooker and Arnott, *P. laxa* and *P. minor* are regarded as varieties of the same species. Mr. Baking-

ton, who, in his 'Manual,' has apparently taken much pains to point out the differences between them individually, and between them mutually and *P. alpina*, remarks, independent of peculiarities to be noted in the uppermost leaf of each, that the uppermost node or joint of the latter is exposed, while in the two former it is concealed by the sheath of the lower leaf,—a character surely too dependent upon the accidents of growth to be available in the establishment of a variety, far less of a species.

Like many other alpine grasses, the two above described are often viviparous, and in this state they are scarcely distinguishable, unless by their narrower foliage, from the corresponding form or state of *P. alpina*.

Poa alpina. Alpine Meadow Grass. Plate LVIII.

Panicle erect, spreading when in flower. Spikelets ovate, three- or four-flowered; flowers free (unconnected by a web). Lower palea with three silky veins, and downy between them. Uppermost leaf shorter than its sheath, "folded and rounded behind the tip" ("cymbiform at the apex"). Leaves broadly linear, obtuse; ligule of the upper ones oblong, acute,—of the lower ones short, obtuse.

Poa alpina, *Linnæus*. *E. B.* 1003; ed. 2. 126. Generally adopted.

A truly alpine species, very abundant in all the loftier mountainous districts of Great Britain and Ireland, growing as well on the highest peaks as on the sides of the rocky passes and valleys that intersect them. Roots fibrous, tufted. Stems erect, six inches to a foot in height, often enlarged at the base when growing in very dry places, somewhat in the manner of those of *P. bulbosa*. Leaves mostly radical, rather short compared with their breadth, which, though exceedingly variable, is usually much greater than that of the other species (?) of this section of the genus: they have a glaucous hue, and terminate more or less obtusely, but are furnished with a short inflexed point or mucro: the uppermost are in general strikingly distinguished from the lower by the form of the ligule, which, though not always positively acute, is considerably elongated, instead of being short and ending abruptly. Panicle about two inches long, ovate in the general outline, spreading its short branches at the time of flowering, but contracting afterwards so as sometimes to appear almost spicate. Spikelets broadly ovate, in luxuriant specimens four- or five-flowered. Glumes ovate-lanceolate, compressed; the middle or keel-vein, of the outer one especially, rough, and terminating beyond the apex of the glume in a short stiff point or awn; the two lateral veins

very short. Outer or lower palea ovate-lanceolate, somewhat pointed, diaphanous at the margin; the keel-vein and two lateral ones silky, with downy spaces between them. See the magnified figures: *a*, the spikelet; *b*, the separated webless flower.

Perennial. Flowers from June to August.

It is very frequently viviparous, the flowers being supplanted by little leafy bulbs, one of which is exhibited on our plate. *See the observations on this subject in the Introduction, page* xviii *et seq.*

This is one of the most commonly distributed of all the alpine grasses, being met with on all the great mountain-ranges of Europe, central and northern Asia, and North America, displaying in different situations great diversity in general aspect, and thence affording almost unlimited opportunity to the ardent discoverer of new species for the exercise of his ingenuity in their fabrication.

I have endeavoured to embody in the foregoing description of the Alpine Meadow Grass, as well as in those of the rest of the division it represents, all the leading characteristics by which the more careful and discriminating authors consider themselves justified in maintaining their separation, and reserve further observations to the close of the section.

Poa cæsia. Grey Meadow Grass. Plate LIX.

Panicle erect, more or less spreading or slender. Spikelets ovate, two- to five-flowered; flowers rather acute, free (not connected by a web). Lower palea five-veined; but with only three of the veins silky. Uppermost leaf about the length of its sheath, folded and slightly incurved, but tapering at the tip. "Uppermost knot near to the base of the stem." Ligule obtuse.

Poa cæsia, *Smith. E. B.* 1719. *Babington. Parnell,* 40. p. 88? Poa glauca β, *E. B.* ed. 2. 133. P. nemoralis var., *Hooker. Bentham.* P. alpina?, *Hooker and Arnott.*

Not unfrequent on the mountains of Wales and Scotland, on the former of which it certainly does not materially differ from *P. alpina.* Scotch specimens I have only seen in the dry state. Stems varying from six inches to a foot or more. Leaves rather broad, not constantly glaucous, or only in very high and exposed situations. Panicle perhaps generally larger and more spreading than in the last-described, but not often so large as in the 'English Botany' figure. The lowest flower of each spikelet is described as being longer than the larger glume; but this feature is very equivocal. The number of flowers contained by a spikelet varies, but not more so than in *P. alpina* and many other grasses. Of the five veins of the lower palea, the two intermediate ones are often so indistinct as to be scarcely traceable, and in the upper flowers their presence seems an exception.

Mr. Babington makes two varieties: *α. cæsia* proper, the panicle of which is rather spreading, and the spikelets four- or five-flowered —to this he refers the E. B. figure 1719 and that on Mr. Parnell's plate 40:—*β. glauca*, distinguished by the broader leaves, the closer panicle, and the spikelets two- or three-flowered only. The habitats given by him for *α*, are Ben Lawers and Clova; for *β*, Ben Nevis and Snowdon. The differences are so liable to alteration by season and situation as to be of small account, in respect, at least, to the recognition of a plant so variable as to be alike identical with the figures both of Mr. Parnell and of the elder Mr. Sowerby. The Snowdon district about Llanberis will be found to yield both of the varieties named in the 'Manual.'

Perennial. Flowers about July. Occasionally viviparous.

Poa cæsia of Sir J. E. Smith, as associated with the 'English Botany' figure 1719, has been very unfortunate in its recognition among later botanists, as indicated by the variety of synonyms above quoted; a circumstance possibly due to the unusually luxuriant state of the panicle represented, which is, however, identical with that of the specimen from which the drawing was made.

In considering the characters by which the Grasses of this section are distinguished from each other, their structural value is surely deserving of our closest investigation, before admitting them to be decisive of separation between species. It is unfortunate for botanical science, so far as regards the correct appreciation of specific limits, that few plant-collectors are either plant-cultivators or vegetable physiologists; and that the enthusiasm which inspires them to the rapid enlargement of their Herbariums, too often leads them to imagine differences where such do not exist, or are only denoted by features so prone to vary as to be utterly valueless in a physical point of view. Our island Flora is rich and varied, and commercial intercourse, aided by natural causes continually in operation, is slowly, from time to time, adding to its extent by introductions from other lands; but few of such immigrations of flowering plants contribute to swell the four volumes of the Supplement to 'English Botany,' or the descriptive 'Manuals' of some of our modern botanical authors. The nineteen British wild roses, forty-one brambles, and indefinite alpine saxifrages, would be sadly diminished if subjected to the test of anatomical investigation. The greater number of these figure as species upon trivial differences in the form and proportions of a leaf or a calyx, or perhaps the presence of a few hairs or gland-like excrescences on a part that is usually smooth.

The discussion of the subject at length is not calculated for the pages of this work, but the rising botanist would do well to regard

all such minor features of comparison as equivocal, unless supported by others less commonly the sport of circumstance. Now, assuming that *Poa alpina* and its associates rival our native roses and brambles in relative position, it is necessary that the principal alleged differences between them should be examined and their value determined. Of the five Grasses above described, *P. bulbosa* and *P. laxa* have the flowers webbed, while in the remainder they are free: the importance of this character is, however, certainly much over-estimated, as in those Grasses generally distinguished by its presence it is not unfrequently absent, and even so in spikelets of the same panicle in which others are furnished with that really striking appendage: *see observation under P. minor*, p. 70. The veining of the lower palea is liable likewise to vary in flowers belonging to the same spikelet; the two intermediate ones, where five are noticed in description, being often scarcely traceable, if not absent altogether. Foliage is so much affected by habitat and exposure, that characters drawn from it in the separation of the plants of this group cannot be relied upon; while the "narrow white, cartilaginous, serrated border" of the leaves of *P. bulbosa* is only a little less conspicuous in the broader ones of *P. alpina* and others. The ligule, of the upper leaves at least, is long and pointed in all, except *P. cæsia*, the true position of which seems a very doubtful point with botanical authors. I place the latter in this section, having always considered it a mere variety of the normal species, and deeming the form of the ligule a feature of questionable value in Grasses generally.

**** Root fibrous, perennial; not stoloniferous. Lower panicle branches in fives or threes, rarely in pairs. Dorsal and marginal veins of the lower palea hairy or silky.*

This section is only separable from the preceding by the more copious branching of the inflorescence, which is far from being constant, and is only adopted as denoting the limits of the probable varieties of *P. nemoralis*.

Poa nemoralis. Wood Meadow Grass. Plate LX.

Panicle rather drooping, with slender branches. Spikelets ovate-lanceolate, two- to five-flowered; flowers more or less webbed at the base. Lower palea five-veined, the central and marginal veins silky. Uppermost sheath not longer than its leaf. "Uppermost knot at about the middle of the stem, exposed." Ligule short, truncate or obtuse.

Poa nemoralis, *Linnæus*. *E. B.* 1265; ed. 2. 134. Generally adopted.

Common in woods and shady places, especially in the North,

where it often constitutes the chief portion of the herbage under the trees. Stems very slender, one or two feet high, smooth, with a tendency to creep, root, and throw up branches at the lower part, but the plant is scarcely stoloniferous. Leaves long and narrow; the ligule usually very short and terminating abruptly. Panicle more or less spreading, with slender branches, two to six inches long, drooping or erect. Spikelets ovate-lanceolate, acute, compressed, very variable in the number of their flowers, which are generally three or four, rarely two only or five. The web is not unfrequently wanting, and seldom very conspicuous.

Perennial. Flowers in June and July.

This is a grass of variable habit, a circumstance which has led to as much multiplication and confusion of species as in *P. alpina* and its allies. The authors of the 'British Flora' unite with it the three following, as well as *P. montana* of Parnell, which scarcely differs from the normal form, unless in its smaller spikelets and webless flowers.

The Wood Meadow Grass is widely distributed over the northern hemisphere, extending in Europe from the borders of the Mediterranean to those of the Arctic Ocean, and being likewise a native of northern Asia and the United States of America. Mr. Parnell places it among "the superior permanent pasture Grasses, producing a considerable deal of fine succulent and nutritive herbage, which horses, cows, and sheep are remarkably fond of;" and observes that, though found growing naturally in shady situations and woods, it will grow freely in exposed places. Mr. Sinclair found it, when cultivated, to be invariably attacked by the "rust." As an economical Grass, its value seems doubtful; in mountainous districts I have never seen it eaten down by sheep, and deer generally leave it untouched in parks. Hares and rabbits devour the herbage, and game-birds are fond of the seeds; hence it might be worth introduction in preserves where it does not grow spontaneously, which is the case in many parts of southern England.

Poa Parnellii. Parnell's Meadow Grass. Plate LXI.

Panicle erect, large, rather close, oblong. Spikelets ovate, two- or three-flowered; flowers acute, free (not webbed at the base). Lower palea five-veined, the central and marginal veins hairy. Uppermost sheath generally longer than its leaf. Uppermost knot at about the middle of the stem, exposed. Ligule very short, truncate.

Poa Parnellii, *Babington, Man. Brit. Bot. E. B. Supp.* 4. 2916. *Parnell, Brit. Grasses,* 210. tab. 93. Poa nemoralis, *β*, *Hooker and Arnott. Bentham.*

First noticed by Mr. C. C. Babington, growing from the crevices of rocks about High Force in Upper Teesdale. Stems ascending, a foot or more in height, very slightly compressed, smooth; bearing usually from four to six leaves with smooth striated sheaths, the uppermost of the latter being almost always longer than its leaf. Of the five or six joints of the stem, several are generally uncovered, the uppermost always so. Ligule very short and truncate, or terminating abruptly, "six times as broad as long, but longer than that of *P. nemoralis*." Panicle rather close, with slender rough branches. Glumes unequal, acute, three-veined, the midvein minutely toothed towards its extremity. "Flowers not webbed, although occasionally one or two longer hairs may be taken for a web." Lower palea five-veined; the central and lateral veins hairy or silky, the intermediate ones more or less obscure, smooth.

Perennial. Flowers in July and August.

The above description is but very slightly abridged from that given of the Grass before us in the fourth volume of the Supplement to the English Botany, and is sufficiently circumstantial, it is to be hoped, to satisfy the most ardent of species manufacturers. As, however, several of the features enumerated are common to *P. nemoralis*, it will be convenient to select those by which it may be known from the latter. I cannot do better than copy a passage to this effect from Dr. Parnell:—"*Poa Parnellii* is distinguished from *Poa nemoralis* by its flowers not being webbed, and its upper sheath being longer than its leaf; whereas in *Poa nemoralis* the flowers are distinctly webbed, and the upper sheath is shorter than its leaf." Now this is terse and decisive; and though we may not agree with the talented author of the 'Grasses of Britain' as to the differential value of the characters thus presented, such is mere matter of opinion between us, open to question and demonstration. In the meantime, facts, minor as they may be, are always valuable in the pursuit of natural science. But what says the discoverer and recorder of *P. Parnellii* in support of the value of these facts, upon the establishment of which it is separable from its congener *P. nemoralis*? Simply this: "*Occasionally* there is a slight trace of a web to the flowers," and that the "upper sheath is *usually* longer than its leaf." What would our great masters in natural history, from Aristotle down to Linnæus and Cuvier, have thought of species, the assumed leading characteristics of which admit the application of such adverbs? Mr. Babington may well remark, that the two plants are, perhaps, too nearly allied.

Poa Balfourii. Balfour's Meadow Grass. Plate LXII.

Panicle erect, rather spreading. Spikelets ovate, three- or four-flowered; flowers webbed at the base. Lower palea five-veined; the central and marginal veins hairy, intermediate ones indistinct. Uppermost sheath about as long as its leaf. Uppermost knot in the lower third of the stem. Ligule prominent, obtuse.

Poa Balfourii, *Parnell. Babington. E. B. Supp.* 4. 2918. Poa nemoralis, ε. *Hooker and Arnott. Bentham.*

Professor Balfour of Edinburgh was the first observer of this Grass, which he found growing on Ben Voirlich, near the head of Loch Lomond. It has since been recognized as not at all unfrequent in the other parts of the Highlands of Scotland, as well as about the more elevated mountainous districts of the north of England and elsewhere. The root is described as creeping, but I have not seen any specimens presenting such a character, or at least more approaching to it than is observable in that of *P. nemoralis.* Stems usually ascending, from three to fifteen inches high, rigid, compressed, very slightly rough; bearing three or four leaves with roughish sheaths, the uppermost of the latter being about the length of its leaf. The knots are so situated as to occupy only the lower third of the stem, and the uppermost one is but rarely exposed, all of them being generally covered by the sheath next below them. Ligule prominent, obtuse. Inflorescence less compound than in the ordinary forms of *P. nemoralis,* erect, one to three inches long; branches more or less spreading, short, rough, the lower ones usually in pairs. Spikelets erect, ovate, two- to four-flowered; the lower flower as long as the larger glume. Glumes unequal, acute, three-veined, the midvein rough, with minute points at the upper part. Lower flowers slightly webbed at the base. Lower palea five-veined; the central and lateral veins hairy, the intermediate ones indistinct, or only observable when held between the eye and the light, smooth.

Perennial. Flowers in July.

Regarding this Grass as a mere variety of the Wood Poa, owing those peculiarities it may possess to its high alpine habitats, I have been careful, as in the case of *P. Parnellii,* not to omit any feature in description to which the slightest value might be attached by the most punctilious observer. It is unquestionably a more marked variety than the latter, but its claim to be regarded as a distinct species is but little enhanced by that admission. Mr. Babington coincides with Dr. Parnell in assigning, as its chief differential characters from *P. nemoralis,* the prominence of its ligule, shorter and lower-placed upper leaf, covered upper joint, and slightly rough stem; but he remarks that English specimens

are more luxuriant than those from Scotland, and differ from them, not only in having more frequently longer, more compound, and many-flowered panicles, but that in them the upper leaf is often inserted rather higher upon the stem, though still "*below the middle*"! The 'Manual of British Botany' is a very valuable field-book, its author an ardent and discriminating practical botanist; he will pardon the non-appreciation of such lax specific distinctions by one whose only aim in observing upon them is to further the advance, on stedfast principles, of their mutually-loved branch of natural science.

From *P. Parnellii* this Grass is considered to be well distinguished by the webbed flowers; but the presence of the web is often equivocal, and, where that appendage is most obvious, it rarely consists of more than three or four long silky hairs, the rudiments of which are sometimes observable in the former plant. Notwithstanding a general difference in aspect, I cannot avoid the impression that the two are not unfrequently confounded by collectors.

Dr. Parnell remarks that sheep seldom eat this Grass, as they give a preference to the *Festuca ovina*, which grows in abundance in the same situations; a fact according with my own observation regarding *P. nemoralis*.

Poa glauca. Glaucous Meadow Grass. Plate LXIII.

Panicle erect, spreading. Spikelets ovate, two- or three-flowered; flowers free (not connected by a web). Glumes unequal, rather obtuse, hairy at the base. Lower palea five-veined, the central and lateral veins hairy or silky, the intermediate ones indistinct. Stipules very short, obtuse.

Poa glauca, *Smith. E. B.* 1720; ed. 2. 132. P. nemoralis ε, *Hooker and Arnott.* P. nemoralis, *Bentham.* P. nemoralis γ. glauca, *Babington*, who, however, does not quote the English Botany figure. P. cæsia, *Parnell.*

A Grass of alpine growth. Stems six inches to a foot in height, rather slender and wiry. Leaves narrow, and, as well as the rest of the plant, very conspicuously glaucous. Panicle erect, from two to five inches long; its branches slender, rigid, much divided, spreading, the lower ones growing by threes. The paleæ are usually more or less variegated with shades of purple, with pale margins, a circumstance which, added to the glossy silk-like hairs of their veins, renders the mass of inflorescence extremely beautiful when the sun is shining upon it.

Perennial. Flowers in June and July.

This Grass, like *P. cæsia* in the preceding section, is one of very doubtful affinity. My own acquaintance with it is confined to

garden specimens. Plants of *P. cæsia*, which somewhat resemble it in hue, occasionally present themselves on the Snowdon range, but I have certainly never met with the *P. glauca*, as described by Sir J. E. Smith, in a wild state. The great inequality in the length of the glumes, and their almost abrupt termination, seem to constitute the leading characters of distinction from its nearest allies. Without being at all satisfied with the direct reference of Mr. Bentham, or the questionable one of the authors of the British Flora, to the English Botany figure under this title as a variety of *P. nemoralis*, I reproduce it in the present work as a guide to future inquirers.

**** *Root fibrous, perennial; not stoloniferous. Lower panicle-branches subverticillate. Dorsal vein of the lower palea hairy; marginal ones smooth.*

Poa trivialis. Rough Meadow Grass. Plate LXIV.

Panicle erect, widely spreading. Spikelets oblong-ovate, two- to four-flowered; flowers acute, connected by a web. Lower palea five-veined; the middle vein only silky or hairy, the others smooth. Uppermost sheath much longer than its leaf. Ligule oblong, acute. Stem and leaves roughish.

Poa trivialis, *Linnæus*. *E. B.* 1072; ed. 2. 129. Generally adopted.

One of the most common of our meadow and pasture Grasses, especially where the soil is moist and rich. Grows in tufts. The stems, decumbent and rooting at the lower part, give it somewhat the appearance of being stoloniferous; but though usually described as creeping, it does not send out any succulent shoots from the base, that, spreading along or beneath the soil, form new plants around the old one. Thus the Rough Meadow Grass ranks among those of its kind distinguished as being fibrous-rooted, an important feature in the eye of the agriculturist. It varies much in height, according to the nature of the land and accompanying herbage, but seldom reaches more than a foot or eighteen inches. Denuded of its leaf-sheaths, the stalk is nearly smooth, unless towards the upper part, below the panicle, where the roughness is readily felt by passing it through the hand from below upwards. The thin flat leaves are likewise rough on both sides, and their sheaths are so externally, the uppermost being always considerably longer than its leaf. Ligule usually very thin, long, and terminating in a point. Panicle, in luxuriant specimens, six or eight inches long and three or four broad at the lower part; the branches very rough, widely spreading in partly unilateral whorls of three or five. Spikelets compressed, ovate, generally about three- or four-

flowered. The silkiness of the middle vein of the lower palea seldom extends more than half-way from its base.

Perennial. Flowers in June and July.

Owing to that general resemblance in aspect which is frequently found to prevail among Grasses of the same genus, an inexperienced collector is liable to confound this species with the following, *P. pratensis*, a mistake that simple comparison of the figures will scarcely rectify. Hence the necessity of longer and more minute description, in this and other instances, than might at first sight appear essential. By careful attention to the features detailed, the Rough and Smooth Meadow Grasses may be easily recognized; but the tyro will do well to recollect that there is no royal road to knowledge.

Though one of the commonest of European Grasses, as indicated by the specific name, and distributed over the whole northern hemisphere, from the latitude of the Mediterranean to the Arctic Circle, *Poa trivialis* scarcely presents any tendency to the production of *varieties*, so frequent among other species of this genus and its allies; a circumstance probably dependent upon its almost exclusive preference for moist habitats, and apparent incapability of subsisting long enough in any other to acquire a new or different aspect through seed-propagation.

The only variety hitherto noticed by botanists is figured by Dr. Parnell, plate 35 of his 'Grasses of Great Britain,' under the name of

P. trivialis parviflora. Spikelets small, one- or two-flowered. Stem generally smooth.

This form is not uncommon in moist shady woods, and, as observed by Dr. Parnell, might, at the first view, be mistaken for the slender narrow-leaved one of *P. nemoralis*, figured in his plate 36 of the same work, unless by careful attention to the character of the ligule and lower palea. Though generally quoted as such, it is not, strictly speaking, a *variety*, not being permanent, but when planted in the garden returning to the normal condition of its species.

Agricultural writers in general extol this Grass highly for its nutritive qualities and abundant produce; and it is certain that not any among our indigenous species are more generally liked by sheep and cattle of all kinds. Its merits, however, have their limits, and a moist rich soil is essential to their development. Where this latter exists, no grass is better adapted for constituting a leading portion of both permanent and alternate pasture; but when sown on dry exposed situations, according to Mr. Sinclair, its produce is not only from the first inconsiderable, but yearly diminishes, and ultimately, within four or five years, it dies off altogether, a fact quite consistent with its natural predilection for

moisture. The same experimentalist ascertained that its produce is always much greater when combined with other grasses, than when cultivated by itself; and that, with a proper admixture of the latter, it becomes nearly doubled, though on the same soil, so much does it delight in shelter. He adds, that this grass should be cut for hay when in seed, as the loss sustained by taking the crop at the time of flowering exceeds one-fourth of its value. Loudon mentions *P. trivialis* as being well adapted for forming grass plots in towns, and in confined situations generally, remarking, that this and *P. annua* are almost the only species of grass that will flourish under the circumstances; a fact that an examination of the turf in most of the old London squares tends to corroborate.

***** Root stoloniferous (sending out creeping shoots or stolones).

Poa pratensis. Smooth Meadow Grass. Plate LXV

Panicle erect, widely spreading. Spikelets oblong-ovate, three- or four-flowered; flowers acute, more or less copiously webbed. Lower palea five-veined; the dorsal and marginal veins hairy. Uppermost sheath much longer than its leaf. Ligule obtuse. Stem and leaves smooth.

Poa pratensis, *Linnæus. E. B.* 1073; ed. 2. 130*. Generally adopted.

No species is more common; but it seems to prefer lighter and drier soils than *P. trivialis*, which, however, it frequently accompanies. Being less affected by deficiency of moisture than the latter, it has a wider distribution, and has hence a much greater tendency to assume that diversity of size and aspect necessary to constitute varieties. The creeping or stoloniferous habit is much influenced by the nature of the soil, being in some instances a very prominent feature, while in others it would scarcely be observed. Stems a foot to eighteen inches high. Leaf-sheaths smooth, striated, the uppermost always much longer than its leaf. Leaves narrow, flat, often roughish on the margins, but smooth on the under surface; the ligule short and blunt, never pointed. Panicle spreading, three or four inches long; the branches slender, rather rough, forming partly unilateral whorls of three or five. Spikelets slightly compressed, oblong-ovate, about four-flowered, stalked, or nearly sessile. Outer palea of the lowermost flower five-veined; the dorsal and marginal veins hairy towards the base. The webbing of the flowers is usually very copious and conspicuous.

Perennial. Flowers in June and July, but generally much earlier than the rough meadow grass.

To enumerate the varieties of this common grass would be of small use to the student, without accompanying the descriptions with figures, which would extend our work far beyond the proposed limits. The leading features of the species are—the copiously webbed flowers, the hairy marginal veins of the lower palea, and the short obtuse ligule,

characters universally present in all of its forms; one of the latter, *P. subscærulea* of the 'English Botany,' is figured in Plate LXVI, as indicating the striking difference in general aspect which soil or situation may occasionally produce without alteration of structure.

Although the differential characters assigned to this grass and *P. trivialis* are individually, perhaps, of slight value, their constancy renders them important in the aggregate, associated as they are with a form of growth altogether dissimilar. No two species of a genus are more decidedly distinguished.

Poa pratensis produces abundant foliage, and at an earlier season than most of our other common meadow and pasture grasses; hence, being a favourite food of cattle generally, it might be considered one of the most valuable, did not its creeping habit interfere with the growth of others equally luxuriant and better adapted for the promiscuous crop of the hay-field. Its earlier flowering, often about the first week in June, is otherwise disadvantageous, as its seed is ripening at the period when most of its associates are in full blossom, and, if allowed to remain uncut until this occurs, a loss of more than one-fourth of the crop is sustained. In addition to these objections to its employment under the improved system of agriculture, it may be remarked that all creeping plants tend to impoverish the soil over which they spread; a fact evinced by their natural habit of sending out their new stems to seek that nutriment at a distance which the older ones have exhausted near at hand. Thus a grass once regarded as being among the most useful of British species, and under this view still dispensed by our unpractical seedsmen, is considered by most experienced cultivators as a weed.

The flower-stems have been used in this country for manufacturing straw-plait, in imitation of Leghorn, and the imitation is said to be very successful.

The Smooth Meadow Grass appears to be distributed over the whole northern hemisphere, at least within the temperate zone.

Poa subscærulea. Glaucous Meadow Grass. Plate LXVI.

A mere alpine or starved variety of *P. pratensis*.

Poa subscærulea, *E. B.* 1004. P. pratensis, var. *E. B.*; ed. 2. 130. generally so considered. P. cærulea, *Sinclair*.

The appearance of this grass is so dissimilar to that of *P. pratensis*, not only in its normal form, but in most of its varieties, that, without close examination, it might readily be mistaken for a distinct species. The inflorescence is more compact; the spikelets broader and more strictly ovate, and usually three-flowered; the leaves proportionately broad and short, somewhat folded and compressed at the upper part, or rather incurved and rounded at the back, of a more or less glaucous hue, often tinged with purple. Setting aside these peculiarities, which are altogether independent of structure, the identity of species is beyond question. The present is not an exclusively alpine plant, though common in the mountainous districts of Wales, and the north

of England and Scotland; it is not at all unfrequent on walls and rocks, or even on very dry sandy soils, especially near the sea.

According to Sinclair, it contains a considerable quantity of bitter extractive matter, and the same author has noticed that hares left it untouched during five successive years, while they cropped the normal form which grew in the immediate vicinity.

Poa compressa. Flat-stemmed Meadow Grass. Plate LXVII.

Panicle erect, more or less spreading when in flower, somewhat unilateral, spikelets oblong-ovate, five- to seven-flowered; flowers obtuse, the lower ones webbed. Lower palea with three hairy or silky veins. Uppermost sheath about the length of its leaf. Ligule short, obtuse. Stem, compressed from the base.

Poa compressa, *Linnæus*. *E. B.* 365; ed. 2. 125. Generally adopted.

Frequent in dry situations, especially on waste land, where the soil is barren and unretentive of moisture, and on walls, road-sides, and rocks. In habit it is not dissimilar to *P. pratensis*, the stolones or creeping shoots sending up erect strongly-compressed stems a foot or more in height. Leaf-sheaths smooth, striated, the uppermost not longer or even shorter than its leaf. Leaves flat, acute, rough on the margins, and often so on the upper face, smooth beneath. Ligule very short and blunt. Panicle oblong, two or three inches long; the branches short, spreading when in flower, nearly unilateral, many of the spikelets sessile. Outer palea three-veined; the veins hairy towards the base. Flowers webbed, but less copiously so than in the preceding species.

Perennial. Flowers from June to September.

In geographical distribution it accords with *P. pratensis*.

There is much in the general aspect of the flat-stemmed meadow grass that seems to favour its being a separate species. The remarkable compression of the stem, usually more abundantly-flowered spikelets, and three-veined outer palea, constitute its leading distinctions: the first is very constant, the second too variable to be of any importance, the last not to be depended upon, as the intermediate veins, and sometimes even the marginal ones, of *P. pratensis*, are liable to be obscure and inconspicuous.

It is said to be liked by cattle, and produces its foliage very early in the spring, but the latter is too scanty to prove of much service. However nutritious analysis has shown it to be, the same objections apply to it in cultivation as to the species of which I am inclined to consider it only a marked variety.

Poa polynoda of Dr. Parnell, adopted by Mr. Babington in his 'Manual,' is by many botanists regarded as a variety of the present. I am not sufficiently acquainted with this grass to offer an opinion as to its specific validity or otherwise; but if its claims as a species rested on its webless flowers and five-veined outer palea be rejected, it only enhances the view already expressed in this work, concerning the

utter worthlessness of such characters of distinction being employed in the arrangement of the plants before us.

The authors of the 'British Flora,' remark, under *P. compressa*, that its flowers are "by no means always connected by a web; in French and North American specimens, and in those from this country, there is often not the least trace of one, yet they are not otherwise distinguishable. In α (the normal form) there are usually only three veins to the outer palea, all of them silky; but an intermediate pair may be occasionally detected, and this constitutes *P. subcompressa*, Parnell. In β (*P. polynoda*, Parnell) we have always observed five veins, of which sometimes the two lateral ones and the midvein are silky, sometimes only the former; sometimes all are naked."

P. polynoda was first observed by Dr. Parnell, growing in small patches on rather dry stony soil, in the vicinity of Edinburgh, where it comes into flower about the last week in June, and ripens its seed towards the close of July. Plants reared from seed retained the characters of the original, differing only from the wild state in the increased size of the panicle. According to the account of its discoverer, the learned author of the 'Grasses of Britain,' it does not appear to be liked by cattle, "the leaves being always found entire, while the surrounding foliage of other grasses was cropped close to the ground. This is probably owing to the large quantity of silicious matter contained in the sheaths and stems, which is considerably greater than that found in other grasses, rendering the herbage hard and disagreeable to the mouths of cattle. When dry, it might form a substitute for fine sand-paper, and prove valuable to turners for polishing wood. The minute granular surface can be very perceptibly, though disagreeably, felt by drawing the stem through the teeth."

The circumstances above detailed may result from peculiarity of habitat, or may be really indicative of distinction as a species. At present I incline to the former view, and to the belief that *Poa pratensis* is not alone the type, but the origin of all the supposed species of its section—in other words, of all the stoloniferous forms of the genus as it is at present circumscribed.

Genus 29. SCLEROCHLOA. Hard Grass.

Gen. Char. Inflorescence paniculate, generally more or less compact. Spikelets many-flowered, rarely three- or four-flowered only. Glumes two, unequal, acute, membranaceous. Paleæ two, membranaceous; the lower one five-veined, cylindrical below, often keeled at the tip, or terminating with a very minute mucro.

A genus established by Palisot de Beauvois. The species, originally included in *Poa*, are grasses of little value, unless as colonists, vegetating almost exclusively on sandy sea-shores; a few grow in salt marshes occasionally overflowed at spring-tides, others inland, on walls or rocks, or in very dry, barren ground, unfavourable to the development of more nutritious herbage.

The name, from the Greek *scleros*, hard, and *chloa*, grass, is significant of the harsh, almost wiry character of the stems.

SCLEROCHLOA MARITIMA. Creeping Sea Hard Grass. PLATE LXVIII.

Panicle erect, the lowermost branches in pairs or simple. Spikelets linear, adpressed, five- to eight- or ten-flowered. Lower palea obtuse, apiculate, the mid-vein reaching the point. Leaves convolute. Roots stoloniferous.

Sclerochloa maritima, *Lindley. Babington.* Glyceria, maritima, *Smith.* Poa maritima, *Hudson. E. B.* 1140; ed. 2. 122. *Hooker and Arnott. Parnell. Bentham.*

Frequent in saline marshes and rather moist sandy places on the sea-coast, often spreading widely by means of its creeping scions or stolones. Stems decumbent at first, and rooting at the joints, afterwards ascending and erect, more or less compressed, a foot or more in height. Leaves generally involute, occasionally flat, rather short, hard and almost pungent at the apex. Ligule obtuse, ovate. Panicle rigid, nearly unilateral, three- to five-inches long; the lower branches in pairs, or sometimes, in luxuriant specimens, two or three together, upper ones often simple, all tending to an erect position after flowering, rarely widely spreading during the latter period, and never deflexed. Spikelets linear, shortly stalked, usually six- or eight-flowered. Glumes rather acute, or at least pointed, three-veined; the outer or lower one shorter, and neither of them reaching the apex of the lowermost flower. Paleæ nearly equal, the lower one five-veined, the upper two-veined.

Perennial. Flowers in July.

Distributed on most sea-coasts of the northern hemisphere, from the latitude of the Mediterranean to the Arctic Circle.

SCLEROCHLOA DISTANS. Reflexed Hard Grass. PLATE LXIX.

Panicle erect; its branches slender, distantly whorled, spreading, eventually deflexed. Spikelets linear, three- to six-flowered. Lower palea obtuse, the mid-vein not reaching the apex. Leaves flat. Root fibrous (not stoloniferous).

Sclerochloa distans, *Babington.* Glyceria distans, *Smith.* Poa distans, *Linnæus. E. B.* 986; ed. 2. 121. *Hooker and Arnott. Parnell. Bentham.* Festuca distans, *Kunth.*

Far from being an uncommon grass, in England especially, though less generally distributed in these islands than the preceding species. While the latter prefers moist habitats, the present is always found on dry ground, and though more frequent near the sea, appears equally at home in barren sandy situations, far inland. Wherever met with, it forms tufts, springing from a clustered fibrous root, without any tendency to the creeping or stoloniferous habit. Stems sometimes

slightly decumbent at the base, from a foot to eighteen inches in height, smooth, rigid. Leaves flat, acute, roughish on the upper face. Ligule, short, broad, abrupt. Panicle three to six inches long: the branches long, slender, spreading when in flower; arranged at the lower part in somewhat unilateral distant whorls of four or five together, which ultimately become rigidly deflexed or bent downwards, a character that strikingly distinguishes this grass from *S. maritima* and others of the genus. Spikelets linear, or approaching to elliptical, seldom more than four- or five-flowered. Glumes very unequal, shorter than the lowermost flower of the spikelet. Lower palea five-veined, the middle vein not extending to the summit.

Perennial. Flowers in July and August.

Most botanical authors seem to regard *S. distans* as a very near ally of *S. maritima*, and some incline to consider the two as varieties of the same form. The great difference in habit seems decisive on this point, and I have not observed any change produced under cultivation which would tend to affect their allotment as separate species.

In geographical distribution *S. distans* nearly accords with *S. maritima*.

The peculiarity of its inflorescence renders this species deserving a place on rock-work, or in the alpine garden.

Sclerochloa Borreri. Borrer's Hard Grass. Plate LXX.

Panicle erect, spreading when in flower; branches half-verticillate. Spikelets linear, four- to seven-flowered. Lower palea obsoletely five-veined; the middle vein extending beyond the summit as an apiculus or mucro. Leaves flat. Root fibrous, tufted.

Sclerochloa Borreri, *Babington*. Glyceria Borreri, *Babington in E. B. Supp.* 2797. G. conferta, *Fries*. Poa Borreri. *Hooker and Arnott. Parnell.*

Found in muddy salt marshes, and on the borders of ditches near the sea, on the southern and south-eastern coasts of England. It was first noticed as a native species by Mr. Borrer, near Gosport, but has since been ascertained to be not unfrequent along the whole line of coast from Dorsetshire to the Wash. Root tufted, sending up several smooth, compressed, more or less decumbent stems, six inches to a foot in height. Leaves short, flat, or partly involute. Ligule short, scarcely obtuse. Panicle two or three inches long, more or less compact or spreading; its branches when most expanding rather ascending than deflexed. Spikelets usually four-flowered. Glumes membranaceous at the margins. Lower palea obscurely five-veined, the middle vein terminating beyond the apex in a short mucro; upper palea with two fringed or ciliated veins, rounded at the summit, or very slightly emarginate.

Perennial. Flowers in July. It is sometimes described as annual, but it survived three or four years in a garden.

The authors of the 'British Flora' remark that this plant is "obviously intermediate between *Poa distans* and *Poa procumbens*," the preceding

and following species of *Sclerochloa*. The latter grass, which it frequently accompanies, is unquestionably a near ally, a slight difference of habit excepted.

SCLEROCHLOA PROCUMBENS. Procumbent Hard Grass. PLATE LXXI.

Panicle more or less compact, ovate-lanceolate; branches distichous, rigid, rough. Spikelets linear-lanceolate, four- or five-flowered. Lower palea obtuse, with an apiculus formed by an extension of the middle vein beyond the upper margin. Leaves flat, with inflated sheaths. Root fibrous.

Sclerochloa procumbens, *Beauvois. Lindley. Babington.* Glyceria procumbens, *Smith.* Poa procumbens, *Curtis. E. B.* 532; ed. 2. 123. *Hooker and Arnott. Parnell. Bentham.* Poa rupestris, *Withering.*

Frequent in saline marshes and on waste ground on the sea-coast of southern England; more rare in Scotland and Ireland. Stems procumbent, rarely when growing in water erect, rigid, round, smooth, six inches to a foot or more in length. Leaves flat, rough on the upper surface, sharply pointed. Sheaths inflated. Ligule oblong. Panicle about two inches long, generally compact, lanceolate inclining to ovate: the branches distichous, but directed to one side. Spikelets seldom more than four-flowered, linear-lanceolate. Glumes obtuse, shorter than the lower flower. Lower palea slightly hairy at the base, obtuse at the summit, but having a mucro formed by the projecting extremity of the middle vein; upper palea rather shorter than the lower. Whole plant usually glaucous.

Annual. Flowers in July.

This grass appears to be chiefly confined to the western shores of Europe, from Spain to the mouth of the Elbe.

SCLEROCHLOA RIGIDA. Wiry Hard Grass. PLATE LXXII.

Panicle erect, rigid, lanceolate, sometimes compact and spike-like; branches short, distichous, inclining to one side of the bordered rachis (main stalk of the inflorescence). Spikelets linear-acute, seven- to ten-flowered. Glumes acute, single-veined; summit of the upper one extending to the base of the third flower of its spikelet. Lower palea obtuse, obscurely five-veined; the middle vein extending into a mucro.

Sclerochloa rigida, *Link. Lindley. Babington.* Glyceria rigida, *Smith.* Poa rigida, *Linnæus. E. B.* 1371; ed. 2. 124. *Hooker and Arnott. Parnell. Bentham.* Festuca rigida, *Kunth.*

A very common grass on rocks, walls, and dry waste places and hedge-banks, in a sandy and gravelly soil; varying, according to circumstances, from two to six or eight inches in height. Root fibrous. Stems erect, or decumbent at the base, round, striated, slender, stiff

and wiry. Leaves linear, nearly flat, taper-pointed, involute and bristle-like, very rigid. Ligule oblong, pointed, often jagged. Panicle erect, one to three inches long, with an angular or bordered rachis; in the larger plants with numerous short, alternately disposed, unilateral branches, and a lanceolate or linear-lanceolate general outline; in smaller, the spikelets are sometimes sessile, and the general mass of inflorescence so compact as to present the appearance of a spike. Spikelets linear, compressed, with usually about eight rather loosely-disposed flowers. Glumes without lateral veins, acute, unequal; the upper one reaching to the base of the third flower. Lower palea five-veined, the marginal veins usually broad and distinct, the intermediate ones scarcely perceptible, the central one extending into a very short but obvious mucro.

Annual. Flowers in June and July, soon after which the foliage dries up and becomes bleached, while the rigid wire-like stems assume a dark red or purple hue, and continue long after the scattering of the seed has taken place.

Where this grass grows about rabbit-warrens, which is the case in some sandy districts towards the sea, the young foliage is often cropped by the animals, but apparently rather in default of more succulent herbage at the period, than in consequence of any instinctive fondness for it as food.

Without very strict attention to their respective descriptions, small specimens of *S. rigida* are liable to be mistaken for the next species *S. loliacea*, between which and the present there is considerable difficulty in establishing determinate characters of distinction, although the latter-named plant was, until recently, referred to a widely-separated genus. So uncertain are our existing means of classification.

The geographical distribution of *S. rigida* does not appear to be a very wide one, being, exclusive of its British habitats, limited to central and southern Europe, and the basin of the Mediterranean. In these islands it can only be regarded as a common plant in the south of England and Ireland. In Scotland, it is only of local occurrence, and chiefly in the vicinity of Edinburgh; nor is it found at any considerable elevation above the sea-level in countries farther south.

Sclerochloa loliacea. Dwarf Hard Grass. Plate LXXIII.

Panicle unilateral, racemose, or spike-like, erect, or slightly curved. Spikelets oblong-ovate, many flowered. Upper glume reaching to the base of the fourth flower. Lower palea obtuse, terminating with a mucro. Root fibrous.

Sclerochloa loliacea, *Woods. Babington.* Triticum loliaceum, *E. B.* 221; ed. 2. 181. Catapodium loliaceum, *Lindley.* Poa loliacea, *Hudson. Hooker and Arnott. Parnell.*

A grass of the sea-side, growing in tufts in the crevices of rocks, and on sandy shores, often within reach of the tide, especially along the coast of England; less common in Scotland and Ireland, but

generally abundant in those places where it occurs. The whole plant is exceedingly rigid and wiry, varying in height from two to four or five inches at most. Stems usually decumbent at the lower part, rather thick compared with their length, smooth, striated. Leaves linear, rigid, flat, or only becoming convolute when dry. Panicle dense, often resembling a spike, or otherwise with the spikelets arranged as a raceme. Spikelets mostly solitary, on short footstalks, ovate, oblong, or occasionally linear; six- to twelve-flowered; alternately disposed upon the rachis, but inclining to one side. Glumes nearly equal, the apex of the upper one reaching to the base of the fourth flower, a feature remarkably constant if of any real value. Lower palea more or less distinctly five-veined; the marginal veins broad and well marked, and often with a white line down the middle; the dorsal one extended beyond the obtuse extremity of the palea as a short point or mucro.

Annual. Flowers in June and July.

Although the generic allotment of this little grass has been long undetermined, as the above synonyms sufficiently indicate, while the affinities of *Sclerochloa rigida* have seldom been questioned, they correspond so closely in structure as to render their specific separation even problematical, some states of the latter species being all but undistinguishable from the present. Modern writers have not much relieved the difficulty by pointing out the difference in the comparative length of the upper glume, reaching in one case to the base of the third flower of the spikelet, in the other to that of the fourth. A dissimilarity in habit or general aspect, familiar to my eye from boyhood, renders me averse to the decision that they are mere local varieties, and raised, from seed, in the inland garden, *Sclerochloa loliacea* retained its usual character, or only differed in being rather less glaucous than its sea-side progenitors: still, in the absence of more marked structural characters, its individuality is doubtful. Withering, who regarded it as a species of *Triticum*, in opposition to Hudson, who classed it as a *Poa*, remarks "the serpentine spike-stalk (*rachis*), which from the spikelets facing one way becomes visible behind through its whole length, has a strong wood-like mid-rib, edged with a thinner and greener border, the same as in the *Poa rigida*." Apart from the natural maritime habitats of the present, its geographical distribution nearly accords with that of the last species.

Genus 30. GLYCERIA. Sweet Grass.

Gen. Char. Inflorescence, more or less branched and loosely paniculate. Spikelets stalked, four- to many-flowered. Glumes two, single-veined, unequal, obtuse, membranaceous, small, shorter than the paleæ of the lowermost flower. Paleæ two; the lower one seven-veined, with scarious margins, subcylindrical; the upper one shorter, bifid at the apex, with two marginal veins.

Nearly allied to *Poa*, of which genus it is by many botanists only regarded as a section, while by others it is ignored altogether. The

genus, proposed by Dr. R. Brown, and adopted by Sir J. E. Smith, as at present limited, consists of certain species of large, handsome, aquatic or semiaquatic grasses, abounding in nutriment, and containing a considerable quantity of sugar; from which latter circumstance the name is bestowed, from the Greek *glyceros*, sweet.

GLYCERIA AQUATICA. Reed Sweet Grass. PLATE LXXIV.

Panicle erect, repeatedly branched; branches rough, widely spreading. Spikelets numerous, stalked, ovate or passing into linear-oblong, compressed, about six- or eight-flowered. Flowers obtuse. Lower palea seven-veined, the dorsal vein extending to the summit. Leaves broad, channeled. Root creeping.

Glyceria aquatica, *Smith. Babington.* Poa aquatica, *Linnæus, E. B.* 1315; ed. 2. 120. *Hooker and Arnott. Parnell.* Hydrochloa aquatica, *Hartman. Lindley.*

Very common on the banks of rivers, ditches, and ponds, often growing in the water. Root creeping. Stems three to six feet high, erect, smooth, slightly compressed and two-edged. Leaves long, broad, channeled, rough on the margins and keel. Ligule short, obtuse. Panicle erect, large, spreading, six to ten inches long, and four or five broad, tinged with brown or purple; branches slender, angular, rough, often much divided. Glumes small, obtuse, or very slightly acuminated. Outer palea, of the lowermost flowers, especially, with seven prominent veins; that of the upper ones often only five-veined; the middle or dorsal vein rough with minute teeth.

Perennial. Flowers in July and August.

Abundantly distributed throughout Europe in similar situations to those which it occupies here, but the North American plant described under the same name appears to be of doubtful identity.

This is a valuable grass in moist land liable to lie under water at times, being one of the most nutritious, and generally liked by cattle. In some districts, as in the fens of Cambridgeshire and Lincolnshire, and on low marshy ground about the Thames and other large rivers, it may be profitably cut twice or thrice in a season, yielding each time an abundant crop. According to Mr. Sinclair the mowing should take place at the period of coming into flower, as the proportion of nutritive elements the grass then contains is greater than when the seed is ripe, in the ratio of 19 to 17. In some of the districts above mentioned, the richest summer pasturage, as well as the principal supplies of winter fodder, are alike yielded by this useful species. As a set-off against its value in this respect, it ought, however, to be mentioned, that it creeps so rapidly at the root as quickly to fill up the ditches and water-courses, and even slow rivers, thus constituting a formidable obstacle to the improvement of the land by drainage. Curtis has described the mode by which the removal of this and other vegetation of the kind from such channels is effected, and the river or the water-course cleansed out, by means of an instrument called a *bear;* consisting of

an iron roller, with a number of small spade-blades fixed upon it: this is drawn up and down the streams by horses walking along the banks, and cuts and tears up the plants by the roots, which floating are carried away by the flow of the water.

GLYCERIA FLUITANS. Floating Sweet Grass. PLATE LXXV.

Panicle nearly erect, slightly branched; branches nearly simple. Spikelets long, linear, from about seven- to twenty-flowered. Lower palea seven-veined with short intermediate ones at the base, the dorsal vein scarcely extending to the summit. Leaves folded at the mid-vein. Root creeping.

Glyceria fluitans, *R. Brown. Smith. Lindley, E. B.* ed. 2. 119. *Babington*, inclusive of G. plicata. Poa fluitans, *Scopoli, E. B.* 1520. *Hooker and Arnott. Parnell. Bentham.* Festuca fluitans, *Linnæus.*

One of the most common of British Grasses in wet muddy places, and about ponds, ditches, and the banks of rivers, the waters of which are frequently covered by its long floating stems and leaves. Flowering stems, decumbent and rooting at the base, varying according to circumstances, from one to two or three feet in height, round, smooth, and usually comparatively thick and succulent. Leaves long, linear-acuminate, rather rough on both surfaces; the upper ones, especially, folded inward or compressed from the mid-vein; the lower and floating ones flat. Ligule oblong, pointed, often jagged or torn on the edges. Panicle erect or slightly drooping, slender, frequently a foot or more in length; its branches few, mostly simple, or but little branched, slender, roughish, arranged alternately on the rachis in pairs of unequal length, but with an inclination to one side of the latter. Spikelets half an inch to an inch or more in length, erect or more or less divaricated when in flower, linear, variegated with green and white; very variable in the number of the flowers in different specimens, the more luxuriant sometimes presenting fifteen or twenty, while the smaller may not consist of more than six or eight, the lowermost of which is always considerably longer than the larger glume at its base. Outer palea, especially in the lowermost flower, with seven prominent veins, and usually short intermediate veins at the base, the middle veins scarcely reaching the apex, and rough with minute teeth.

Perennial. Flowers from the end of June to August or September.

The character of this grass is so truly protean, that our readers must content themselves with a single figure, although many modern botanists consider that at least two native species have been hitherto confounded, under the above name. It was our intention at first to have given figures of both these, as adopted by Mr. Babington in his 'Manual;' but close examination and repeated comparison of specimens from various localities, have led to a contrary decision. Taking the extremes of form apart from all intermediate developments, *G. plicata* of Fries is sufficiently distinct from the normal *G. fluitans*,

perhaps, to warrant their separation as species, but certainly not in association with the latter, numerous and varied as they are. For the discrimination of the species at large, the figure in Plate LXXV. will be found sufficient: for the satisfaction of the more fastidious student the leading characteristics of its most marked varieties are subjoined.

α.—*G. fluitans*, R. Brown. Leaf-sheaths nearly smooth, striate. Flowers more or less acute. Anthers long (about five times longer than broad).

β.—*G. plicata*, Fries. Leaf-sheaths rough, furrowed. Flowers rather obtuse. Anthers short (from two to four times longer than broad).

To the latter of the two the *E. B.* figures above quoted are usually referred.

In allusion to these and other slight differences observable among specimens of the grass before us, the authors of the 'British Flora' remark that "to those who rely on such points, and on the form and colour of the anthers, for characters, there must be at least six or eight varieties or species in this country, and as many, though not quite the same, in North America." Their estimation is certainly moderate so far as our own islands are concerned.

Certain states of *G. fluitans* and of *Festuca loliacea* nearly approach each other in general aspect, and, when the latter grows in wet situations, a cursory observer is liable to mistake one for the other; but the single-veined glume and seven-veined outer palea, generic distinctions of the former, serve at once to distinguish it from the latter, the only British Grass which at all resembles it in habit.

The Floating Sweet Grass is very generally distributed over Europe and northern Asia, the extreme colder parts excepted; is likewise a native of North America, and, either it or a kindred species, is found in Australia.

Though naturally confined to watery situations, it is said to prove productive when cultivated in comparatively dry ones, and to be thus valuable for permanent pasture in some cases. The only instances in which it would be found to flourish so as to add greatly to the quantity of the crop, are fens, marshes, or river-meadows liable to occasional inundation, and even in such lands it is doubtful whether its introduction is desirable, on account of the creeping habit that tends to exclude other grasses from the soil. Agricultural writers and experimentalists differ in their accounts of the estimation of this grass by cattle: we find it stated by one, perhaps, that it is a favourite with horses, cows, and swine; while another observes that cattle will eat it, but there are many grasses they like better—a discrepancy probably arising from the varied times and circumstances under which their information on this point has been obtained; one fact may be admitted, all herbivorous animals are fond of the seeds as they approach ripeness. The seeds are large, compared with those of most of our common grasses, are easily collected, and having a sweetish flavour, have received the name of *manna seeds*. Under this title they are occasion-

ally met with in our English shops, being used here as a delicacy or luxury for making light puddings and gruels, and for thickening and flavouring soups; but in some parts of the Continent, especially in Germany and Poland, their use is more general, and the plant is cultivated to a considerable extent for obtaining a crop. In regard to nutritive qualities, they hold a high rank among the different kinds of grain, and are said to form a bread, little, if at all, inferior to that made from wheat. They afford a grateful food to all graniverous birds, and to geese, ducks, swans, and other water-fowl especially, as well as to many species of fresh-water fishes, but above all to the trout; hence the growth of this grass on the borders of streams, ponds, lakes, and swampy places about preserves, decoys, &c., is deserving encouragement by those interested.

The sharp bran obtained in the preparation of the manna seeds is used on the Continent for destroying intestinal worms in horses, its action being mechanical, like that of the Indian remedy in the human subject, known as Cowitch, the pungent hairs on the pods of the *Mucuna pruriens*. After administering the dose the horses are kept for a time without water, which is supposed to impair its efficacy.

Genus 31. TRIODIA. Heath Grass.

Gen. Char. Inflorescence raceme-like. Spikelets stalked, alternate, compressed, two- to four-flowered, Glumes two, nearly equal, acute, three-veined, as long as the flowers. Paleæ two; the lower one somewhat coriaceous, rounded on the back, three-toothed at the apex, hairy below; the upper one obtuse, with two marginal veins.

A genus established by Dr. R. Brown for the reception of certain Australian and South American grasses. A single species, formerly associated with Poa, belongs, perhaps, exclusively to Europe. The name, from the Greek *treis*, three, and *odous*, teeth, alludes to the triple division of the apex of the lower palea.

The European plant has much more the habit of a *Festuca* than of a *Poa*, and was by Linnæus placed in the former genus, although regarded by him as allied to *Melica*.

Triodia decumbens. Decumbent Heath Grass. Plate LXXVI.

Panicle erect, usually simple or racemose. Spikelets few, ovate, about four-flowered, not longer than the glumes. Ligule a tuft of hairs.

Triodia decumbens, *Beauvois. Smith. Lindley. Hooker. E. B.* ed. 2. 135. Poa decumbens, *Withering. E. B.* 792. Festuca decumbens. *Linnæus.*

Frequent on mountainous and hilly pastures, heaths, and moors, throughout the kingdom, though chiefly in poor, wet soils, or in such

as, though dry during the summer, admit of the rain collecting upon the surface at other times of the year; hence it is often met with growing on sandy fields and commons. Whole plant usually prostrate and spreading, the stems only ascending and becoming erect at the time of flowering, when they vary in height, according to circumstances, from a few inches to a foot. Leaves linear, acuminate, more or less hairy, rough towards the points. Ligule represented by a tuft of hairs. Inflorescence consisting of a very small number of spikelets, seldom more than five or six, arranged like a raceme; containing three or four flowers each, and standing erect on smooth alternately disposed footstalks. Glumes very nearly equal, lanceolate, very acute, strongly three-veined, smooth, as long as or even longer than the spikelet. Outer palea ovate, convex, or rounded externally, five-veined or ribbed, with a small tuft of hairs on each side at the base; three-toothed at the apex, the middle tooth usually very short and stiff, being an extension of the central vein. Inner or upper palea broad, obtuse, entire at the apex, with two green, marginal, minutely ciliated veins.

Perennial. Flowers in July.

Its presence is always indicative of a poor soil. Harsh, rigid, and insipid, like other colonizing grasses, it is generally rejected by cattle.

Triodia decumbens is almost essentially a European grass, being met with on barren grounds over the whole Continent, from the borders of the Mediterranean to those of the Gulf of Bothnia. It is a native likewise of some parts of Russian Asia.

The peculiarity of the ligule is a marked feature, by which this grass may be readily recognized.

Genus 32. BRIZA. Quaking Grass.

Gen. Char. Inflorescence loosely panicled. Spikelets stalked, much compressed, ovate or deltoid, with from three to eight densely imbricated flowers. Glumes two, nearly equal, broad, obtuse, three-veined, much shorter than the spikelet. Paleæ two; lower one boat-shaped, obtuse, rounded on the back, faintly many-veined. Glumes and paleæ membranaceous, passing into coriaceous, with scarious margins.

A small, but rather widely distributed genus of highly graceful and ornamental grasses, of no agricultural value.

The name, from the Greek *britho*, to droop, suspend, or balance, applies to the position of the broad oval or triangular spikelets, the long stalks of which are so slender as to occasion them to tremble with the slightest movement of the air. The English name is of course expressive of the same result.

All of the species are deserving of attention on account of their beauty; and an annual one, *Briza maxima*, a native of southern Europe, has long occupied its place in the English flower-garden, now and then escaping from the limits of the parterre, and appearing spon-

taneously in the vicinity of towns and villages, but not sufficiently permanent in its wild propagation to be considered as naturalized.

BRIZA MEDIA. Common Quaking Grass, Maiden's-hair, Cow-quakes, Lady's-hair. PLATE LXXVII.

Spikelets broadly ovate, about seven-flowered. Glumes shorter than the lowermost flower. Ligule short, obtuse.

Briza media, *Linnæus*. *E. B.* 340; ed. 2. 137. Generally adopted.

A common grass on open downs and pastures, especially in poor shallow rocky soils, in which it often constitutes the principal vegetation, but rapidly disappears before the advance of cultivation, being soon overpowered by the more succulent and luxuriant species thus brought into competition. An elegant plant, forming tufts, never spreading at the root. Stems from a few inches to a foot or even a foot and a half in height, erect, smooth, and slender. Leaves flat, short, linear, acute. Ligule usually very short, occasionally all but obsolete, always terminating abruptly. Panicle two to four inches long, widely spreading, triangular in general outline; branches smooth, very slender, wiry, wavy or zig-zag, arranged in alternate pairs on the smooth rachis. Spikelets pendulous on long slender footstalks, mostly six- or seven-flowered, broadly ovate, compressed, purple or brown, variegated with green and white. Glumes and outer paleæ nearly corresponding in texture, approaching coriaceous, but with thin or scarious whitish margins. Glumes shorter than the lowermost flower. Lower palea roundish-oval, not gibbous, upper one minute, resembling a flat membranaceous scale.

Perennial. Flowers in June and July.

Eaten by cattle generally in the pastures where it grows, especially by sheep, but of little value on account of the comparatively scanty foliage. For cultivation, even on poor soils, it is altogether unfitted, as the produce would scarcely repay the expense of seed and sowing. In the slow economy of nature it is a pioneer, valuable and efficient in that office, but out of place elsewhere.

Found throughout Europe, the extreme northern parts excepted, in similar situations to those which it occupies in England.

BRIZA MINOR. Lesser Quaking Grass. PLATE LXXVIII.

Spikelets triangular, five- to seven-flowered. Glumes longer than the lowermost flower. Ligule long lanceolate, acute.

Briza minor, *Linnæus*. *E. B.* 1316; ed. 2. 136. Generally adopted by British botanists.

Not indigenous, though long naturalized in the extreme south-west of England, where it occurs occasionally on dry sandy fields and heaths, especially towards the sea: it is likewise met with in the

Channel Islands. Grows in tufts from a fibrous root, sending up erect, smooth, slender stems, varying from two or three inches to a foot in height. Leaves flat, acute, roughish; shorter and broader than those of *Briza media*. Ligule very long, lanceolate acuminate. Panicle much branched and spreading; branches very slender, roughish. Spikelets smaller than those of the last species, and generally more numerous, pale green variegated with white, compressed, triangular. Glumes as long as, or sometimes longer, than the lowermost flower, having, as well as the paleæ, membranaceous and whitish margins. Lower palea broad, obtuse, or roundish-heart-shaped, very strikingly gibbous on the back, cartilaginous; upper one small, thin, flat.

Annual. Flowers in June and July.

Southern Europe, and the basins of the Euxine and Mediterranean, appear to constitute the natural geographical limits of this grass. Although met with occasionally far inland, as in Switzerland and Southern Germany, it is a plant of maritime habitats, of which the shores of the English Channel seem at present to be the boundary northward.

Genus 33. DACTYLIS. Cock's-foot Grass.

Gen. Char. Inflorescence paniculate. Panicle with the secondary branches short and crowded; subunilateral. Spikelets in dense clusters, compressed, three- to five-flowered. Glumes two, unequal, shorter than the spikelet; the lower one keeled. Paleæ two; the lower one lanceolate, compressed, keeled, five-veined, the dorsal vein ciliated or fringed, and extending just below the apex as a short awn; upper one membranaceous, equalling the lower one in size, minutely fringed or ciliated on the margins.

Named from the Greek *dactylos*, a finger, in allusion to the dense round-topped bunches of spikelets of *Dactylis glomerata*, which bear a fanciful resemblance to the end of a finger.

A genus of uncertain limits, so nearly approaching *Festuca*, and perhaps *Poa*, in floral structure, as to be scarcely separable, unless by peculiarity of habit.

Dactylis glomerata. Clustered or Rough Cock's-foot Grass. Plate LXXIX.

Panicle distantly branched. Spikelets forming ovate clusters directed to one side. Leaves linear, flat, rough on the margins. Stem erect. Root tufted.

Dactylis glomerata, *Linnæus*. *E. B.* 335; ed. 2. 138. Generally adopted.

A very common species, growing in almost all soils and situations, in meadows, woods, and by road-sides. A coarse grass, forming com-

pact tufts, and sending up many flowering stems from one to two feet high. Stem erect, round, striated. Leaves linear, flat, terminating acutely, rough, especially at the edges, which are almost toothed with minute siliceous points, broad, rather flaccid notwithstanding their harshness to the touch. Panicle erect, the lower branches distant and spreading, the upper ones often tufted, all turned in one direction; rachis and branches rough. Spikelets numerous, closely clustered, forming ovate masses at the extremities of the branches, on short rough footstalks, usually three- or four-flowered. Glumes membranaceous, lanceolate acuminate, the keel rough or hairy. Lower palea almost cartilagenous; its fringed dorsal vein not quite reaching to the summit, but extending a little below it as a short awn.

The general aspect of the inflorescence varies much in different situations; the branches of the panicle being sometimes, in poor and exposed pastures, so short and so close together as to give it the appearance of a single cluster; while in woods the secondary branches even become so much elongated and spreading, that a person familiar only with the ordinary form might readily mistake it for a different species.

Perennial. Flowers in June and July.

Though apparently a coarse rough grass, and apt to form tussocks or tufts that occasionally much disfigure the pasture, the Rough Cock's-foot is a valuable species; being generally liked by cattle, unless when by understocking or neglect it has been allowed to become rank and disagreeable to their palates. It is one of the earliest and most productive, and, rooting deeply, is less liable to suffer from excess of drought than most others on dry sandy soils; hence in situations so circumstanced, its superiority as a pasture grass is undeniable. As, however, moist, retentive land, is more favourable to its luxuriance, and induces an overgrowth destructive to those of weaker habit, but equally produtive, it may be advisable, as a general rule in laying down grass land, to exclude the *Dactylis* where other species of a finer quality are found to flourish. Mr. Sinclair, in noticing its agricultural capabilities, observes that the herbage, when suffered to grow rank or old, for want of sufficient stocking, contains nearly one half less nourishment than that which is of recent growth. Hence this grass is more valuable for pasture than for hay; and to reap the full benefit of it in the former case it should be kept closely cropped either with cattle or the scythe. Even for hay he considered it far more valuable than *Lolium perenne* and many other grasses, and for an alternate crop by far the best that can be employed alone. The same writer further recommends an admixture of three parts of *Dactylis glomerata* with one part of *Festuca duriuscula*, *Poa trivialis*, *Arrhenatherum avenaceum*, *Phleum pratense*, *Lolium perenne*, and white clover, to "secure the most productive and nutritive pastures in alternation with grain crops on soils of the best quality: and even on soils of an inferior nature, under the circumstances of unfavourable seasons, this mixture will afford nutritive herbage, when the land would have been comparatively devoid of it, if one species of grass only had been employed." In addition to this we are informed, that Cock's-foot constitutes "a part of the herbage of

pastures most celebrated for fattening and keeping the largest quantity of stock in Devonshire, Lincolnshire, and the Vale of Aylesbury."

Few, if any, of our native grasses flourish so well as this under the drippings and shade of trees, hence it is often called in the country Orchard Grass.

It is distributed naturally over the whole of Europe, and the adjoining parts of Asia, except in the extreme northern and colder regions, and is met with in northern Africa, and in the United States of America; in the latter country, however, Mr. Pursh regarded it as an introduction from Europe.

Dr. Parnell seems to have been unaccountably misled, when, in his valuable work on British Grasses, before quoted, he recorded the Cock's-foot, a grass so eminently European, and described as indigenous by our earliest herbalists, as "said to have been originally introduced" to England, it must be presumed, "from Virginia by the Society of Arts."

Genus 34. CYNOSURUS. Dog's-tail Grass.

Gen. Char. Inflorescence spike-like, unilateral. Spikelets nearly sessile, distichaus, one- to five-flowered, with a pectinated bract at the base of each. Glumes two, nearly equal, membranaceous, much shorter than the spikelet, one-veined, strongly keeled, pointed. Paleæ two, membranaceous, linear-lanceolate; the lower one rounded on the back, five-veined, with a short rough awn below the apex; upper one pellucid, with the margins minutely ciliated.

The name, associated with the form of the inflorescence in *Cynosurus cristatus*, is from the Greek *cyon*, a dog, and *oura*, a tail.

The genus, always one of small extent, has been much curtailed by modern botanists, by some among whom even the two British species are disjoined. The inflorescence is peculiar among grasses, or appears so on the first view, on account of the so-called *bract* at the base of the spikelets: this curious appendage is, however, itself an abortive spikelet, consisting of a series of lanceolate or linear outer paleæ placed alternately upon a rachis above each other, in accordance with the arrangement of the flowers in the fertile spikelet which it accompanies. The spikelets then, strictly speaking, must be regarded as growing in pairs, one of each pair being constantly barren while the other is fertile. The regular pectinate or comb-like form of these appendages renders the mass of inflorescence very beautiful, and deserving of a close inspection, which, at the same time, quickly renders their true character unequivocal.

Cynosurus cristatus. Crested Dog's-tail Grass. Plate LXXX.

Panicle interruptedly spicate, or raceme-like, elongated linear. Spikelets nearly sessile, more or less distant, directed in two rows to one side of the rachis. Flowers with a very short awn.

Cynosurus cristatus, *Linnæus*. *E. B.* 316; ed. 2. 139. Generally adopted.

Usually abundant on gravelly, chalky, and rocky pastures and meadows, but chiefly in a dry soil, growing in tufts. Stems from a foot to eighteen inches high, smooth, slender. Leaves narrow, acuminated, roughish on the upper side. Ligule short, obtuse. Inflorescence from one to three inches long, erect, linear, interrupted or compact, usually of a light green colour; the lateral branches so short that the spikelets appear sessile. Spikelets generally from three- to five-flowered, arranged in two series, both inclining to one side of the rachis: each accompanied by a beautiful doubly pectinated appendage at the base, which, though denominated by some botanical writers a *bract*, and by others, with even less propriety, an *involucrum*, is generally admitted to be an abortive spikelet, as described under the above notice of the genus. The divisions, comb-like teeth, or abortive paleæ of the appendage in question are in this species linear, acute, but not long-pointed, and a little curved inward at the apex. Glumes narrow-lanceolate, acute, rough at the keel. Outer palea linear-lanceolate, very obscurely five-veined, rounded behind, the middle vein roughish, and terminating in a rather short rough awn: inner palea bifid at the apex, thin and pellucid.

Perennial. Flowers in July and August.

In the situations natural to this grass, high and dry pastures or sheep-downs, no species is more valuable, not only on account of the compactness of its fine short foliage, which is highly agreeable to the close-cropping animals that feed upon them, but, because, owing to the depth to which its roots penetrate, it remains green through the driest part of the summer, or at least long after most other species have withered. Deer, as well as sheep, are exceedingly fond of it, hence it is recommended for parks. Mr. Sinclair accords with some of the older agricultural authors as to its fitness for permanent pastures, more especially owing to its being less liable to injury by drought than grasses of a superior quality; but it is not at all adapted for general cultivation, the stems being too harsh and wiry, and the herbage unproductive where a crop of hay is required. In the latter case, where it constitutes any considerable proportion of the turf of the meadow, the mowing should take place at the time of flowering, the stems being then more succulent and nutritious, and the yield more abundant than either before or afterwards.

Although frequently forming the principal part of the sward, in the situations above mentioned, the Crested Dog's-tail Grass is a common member of the promiscuous vegetation of most grass-lands that have been long undisturbed, unless in such as are marshy.

The slender stems, collected in the green state and carefully bleached, are said to be superior to the Leghorn straw for the manufacture of straw hats and bonnets, a purpose to which, without doubt, those of many other British grasses would be equally applicable.

Found throughout Europe, except in its extreme northern and colder regions, and extending into western Asia.

CYNOSURUS ECHINATUS. Rough Dog's-tail Grass, Hedge-hog Grass. PLATE LXXXI.

Panicle contracted, forming a more or less dense sub-ovate, unilateral spike. Spikelets nearly sessile. Awn equalling in length the outer palea.

Cynosurus echinatus, *Linnæus*. *E. B.* 1333; ed. 2. 140. Generally adopted.

Rare. Found on the sandy sea-coasts and dry pastures in their vicinity in the extreme south of England; occasionally inland about towns, and in other parts of the kingdom, probably owing to the chance distribution of seed from gardens in the neighbourhood. Common in Jersey and Guernsey. Grows in tufts, sending up several erect wiry stems, one to two feet in height. Leaves flat, usually broader and shorter than those of *C. cristatus*, sharply acuminated, rough on both sides, flaccid. Ligule long, pointed. Inflorescense variable in general form, compact, rounded or semi-ovate, half an inch to an inch and a half in length, always one-sided. Spikelets mostly two- or three-flowered. Teeth of the accompanying *bract* (barren-spikelet) linear, long pointed, straight, acute, distant. Glumes, rough on the keel, much longer than the lowermost flower. Lower palea ovate-lanceolate, obscurely five-veined; the middle vein very rough, and terminating in a long, slender, rough awn, equalling in length or longer than the palea.

Annual. Flowers in July.

A sand colonist, indigenous apparently to the basins of the Mediterranean and Black Seas, from which it has been gradually disseminated over southern and western Europe; reaching in the latter our Channel Islands, but scarcely yet established as an English plant, requiring possibly a higher temperature for ripening its seeds abundantly than that usually experienced in this climate; though upon one occasion it is said to have been found on a barren moor in the Shetland Islands. In the garden it grows freely, and sown in tufts is very ornamental, but an ungenial summer has, on more than one occasion in metropolitan Surrey, rendered its renewal by seed from a warmer district necessary; a circumstance that would account for its uncertain recurrence in recorded habitats.

As a mere pioneer to vegetation of a higher grade, it cannot be supposed to possess any immediate agricultural value.

Genus 35. FESTUCA. Fescue Grass

GEN. CHAR. Inflorescence paniculate, spreading or compact, rarely spikelike. Spikelets stalked, many-flowered, rarely three-flowered, more or less laterally compressed. Glumes two, unequal, membranaceous, pointed, much shorter than the spikelet. Paleæ two,

lanceolate; the lower one rounded on the back, very acute, or with the dorsal vein excurrent as an awn a little below the apex; lateral veins slightly converging and disappearing below the apex: upper palea minutely ciliated on the veins. Styles terminal.

An extensive genus, very widely distributed over the north temperate zone, throughout which some of its species constitute no inconsiderable portion of the pasture vegetation, and occupy a high grade among the grasses most remarkable for nutritive qualities; others, however, are mere colonizers, and worthless in an agricultural point of view.

The name is Latin, but of doubtful origin and application, though it seems to have been bestowed, in this instance, in allusion to the supposed foodful attributes of several well-known species or varieties. *Fest* is the Celtic word for food, probably from the same root with the Latin *festum;* but the discussion of an etymological problem must be dismissed to other pages.

As a genus, *Festuca* is not very strikingly distinguishable from either *Poa* or *Bromus*, and close comparison between the generic characters of all the three will be found valuable by those whose previous acquaintance with the species of each is limited.

Our figures of the *forms* of *Festuca* are far more numerous than are the *species*, simply because European botanists are not agreed as to the limits of the latter, and that the variable aspects of some among them are liable to mislead the uninitiated. Hence, we have availed ourselves of the numerous specimens contained in the herbarium of the elder Mr. Sowerby, for the identification of the plants of this genus, published as species in the first edition of the 'English Botany,' for the republication of the whole series; not studying them alone as originals of the figures in that admirable work, but as aids to the determination of examples collected for the present.

The characters of the four sections, denoted by asterisks, indicate the limits of as many genera into which *Festuca* is occasionally divided, but which are not adopted as such by English writers.

* Root-leaves very narrow. Ligule with round auricles. Awl terminal, longer than the palea. Flowers usually monandrous.

FESTUCA UNIGLUMIS. Single-glumed Fescue Grass. PLATE LXXXII.

Panicle nearly erect, one-sided, contracted, raceme-like. Spikelets in two rows. Lower glume very minute, or absent.

Festuca uniglumis, *Solander. E. B.* 1430; ed. 2. 145. *Hooker and Arnott. Babington. Parnell. Bentham.* Vulpia uniglumis, *Lindley.* Mygalurus uniglumis, *Link. Loudon*, Encycl. 64; Hort. Brit. 30.

Very local in its distribution in these islands, where it is almost exclusively limited to the sandy sea-shores of the southern and south-eastern

counties of England, and the south of Ireland; the island of Anglesea appears to be its most northern British habitat. On the continent of southern Europe it occurs in inland situations; but the Mediterranean basin is the chief seat of the species, whence, gradually advancing along the western coasts of the peninsula and France, it has reached our own. It is an annual, or, according to some, biennial; the latter term, however, conveys, especially in regard to grasses, an erroneous notion of duration, as it applies to species whose seeds ripen sufficiently early in the summer to vegetate in autumn, the approach of winter alone preventing the production of their flowers until the following year. The slender, angular, smooth stems grow in tufts, varying from three or four inches to a foot in height. Leaves few, narrow, usually so much rolled inward as to appear thread-like. Inflorescence a simple, racemose panicle, two or three inches long; the spikelets of which, though disposed in two rows, are unilateral, and often so closely set as to form an apparent spike. Glumes five- or six-flowered, more unequal than in any other species of this genus; the outer one, indeed, would appear at first sight to be altogether absent, being an almost microscopic scale, a circumstance that at once distinguishes it from *F. sciuroides*, and its varieties, which nearly resemble the plant before us in general outline. Inner glume long, narrow, much attenuated, pointed. Outer palea terminating in a rough awn more than twice its own length, five-veined: inner one very narrow, thin, two-viened.

Flowers in June, and sometimes late in the autumn in mild dry weather.

A grass of no immediate value, being rigid, dry, and innutritious. Its natural office is that of a colonizer.

FESTUCA SCIUROIDES. Squirrel-tail Fescue Grass. PLATE LXXXIII.

Panicle erect, somewhat racemose, one-sided. Spikelets erect, about five-flowered. Lower glume much smaller than the upper. Upper half of the stem leafless.

Festuca sciuroides, *Koch*. *Babington*, Manual. F. bromoides, *Linnæus*. *E. B.* 1411; ed. 2. 144. *Hooker*. *Parnell*. F. myurus. *Bentham*. Vulpia bromoides, *Lindley*. Mygalurus bromoides, *Link*. *Loudon*, Encycl. 64; Hort. Brit. 30.

The grass thus designated is not of very frequent occurrence, though occasionally found on dry sandy ground, waste places, and road-sides, in various parts of the kingdom. Regarded as a separate species, its continential distribution seems doubtful. With a habit similar to the preceding, the slender stems are not at all angular; and, though variable in height, seldom exceed six or seven inches, the upper part being leafless. The leaves, few in number, narrow, and more or less involute, as in all the plants of this section, afford no distinctive character. Inflorescence erect; the branches rather spreading when in full flower, but contracted before, and afterwards, except the lowermost, which is

often compound, much longer, and stands out from the others. Outer glume always conspicuous, though differing greatly in its comparative length. Awn-like termination of the outer palea rather longer than the palea itself.

Annual. Flowers in June and July.

FESTUCA MYURUS. Wall Fescue Grass. PLATE LXXXIV.

Panicle elongated, drooping, raceme-like, contracted, one-sided. Spikelets erect, five- or six-flowered. Lower glume much smaller than the upper. Stem leafy to the summit.

Festuca myurus, *Linnæus? Smith. E. B.* 1412; ed. 2. 144*: Mygalurus caudatus, *Link. Loudon*, Encycl. 64; Hort. Brit. 30.

Common, in the southern and midland counties of England at least, on walls and barren ground, and occasionally even on arable land in dry situations. Stems slender, tufted, sometimes more than a foot in height. It so closely resembles *F. sciuroides* in all general features, as almost to defy description as a separate species. The greater length of the more compact, drooping panicle, which not unfrequently extends to that of five or six inches; the shortness of its lower branches, and the usually broader and brighter green leaves, are the most striking characters of the Wall Fescue. In its taller and more luxuriant form there are few grasses more beautiful, especially when in exposed situations its tufts of graceful plume-like masses of flowers wave with every breath of wind.

Annual. Flowers in June and July.

In describing and figuring the above three grasses, the author has no intention of insisting on their claim to specific distinction, being himself fully persuaded that they are forms of one. With regard to the latter two, this opinion is entertained by most botanists who have studied the structural modifications to which the plants of this important division of the vegetable kingdom are liable; and though the first, *F. uniglumis*, is retained, in our most recent descriptive catalogues, as a separate species, the only character upon which such separation depends, is the imperfect development of an organ of comparatively small value. The abortion of the outer glume, were it constant, might, it is true, be admitted as constituting a distinctive feature, equivalent to the absence of the inner palea in the flowers of *Alopecurus;* but it is not so, the glume in question being often sufficiently conspicuous to arrest the eye of even a casual observer—while in *F. sciuroides* and *F. myurus* the corresponding organ is occasionally so little developed in some of the spikelets as to be a mere scale.

** Root leaves narrow or setaceous. Awn terminal, shorter than the palea. Flowers triandrous.

FESTUCA OVINA. Sheep's Fescue Grass. PLATE LXXXV.

Panicle erect, one-sided. Spikelets ovate, spreading in two rows, four- to six-flowered. Awn less than half the length of the palea. Culm square. Leaves bristle-shaped.

Festuca ovina, *Linnæus*. *E. B.* 585; ed. 2. 141. Generally adopted.

Very common throughout the kingdom in dry soils, especially on elevated natural pasture land and mountain slopes, on which latter it often constitutes the principal vegetation. It varies considerably in aspect according to situation and exposure, being sometimes not more than two or three inches high, while in other places the flowering stems attain nearly a foot. The slender foliage forms dense tufts of a dark green, but more or less glaucous hue; the radical leaves being individually almost hair-like; those of the stem, usually not more than two or three, very short and more expanded. Ligule bilobate, one lobe longer than the other. Panicle loose and spreading when in flower, afterwards compact, one or two inches or more in length. Outer palea extending into a short awn rarely equalling half its own length.

Perennial. Flowers in June.

The square stem, considered as a marked feature of distinction between this species and *F. duriuscula*, is not to be depended upon, the angles being frequently obsolete, or only traceable immediately below the inflorescence.

Either *Festuca ovina*, or some species so nearly allied as to be generally regarded as the same, is distributed over the whole of the north temperate and Arctic regions, and is said to be likewise indigenous to New Zealand. The normal form, here figured, is so different in appearance from certain others which follow it in the present work, that the rank of distinct species formerly, and, indeed, in some instances still, assigned to the latter, is not altogether unfounded.

As the name bestowed upon it indicates, the Sheep's Fescue is a favourite food of sheep, and cattle generally seem fond of its wiry-looking, but still succulent and nourishing herbage, which in some places, as among the Highlands of Scotland, constitutes almost the entire pasture. In the practice of agriculture it is next to useless, on account of the shortness and thinness of the foliage rendering it entirely unproductive as hay; while for grazing purposes, on temporary pasture, grasses of larger growth are proportionately far more profitable; yielding, as they do, a greater quantity of food upon the same extent of surface. Nature, in her distribution of it on poor sandy and rocky soils, where other species would dwindle and die, points out the only situations to which it is properly adapted. The superiority of the flesh and the fineness of the wool of sheep fed on the upland pastures where it grows have been long known, and are still subjects of comment in this country. Chemical analysis does not assign *F. ovina* a very high position on the list of nutritive indigenous grasses, but it should be remembered, that the most wholesome and health-inspiring food is

not always that which contains the largest amount of readily assimilative matter, and that sugar, starch, and gluten are not the sole constituents of the animal fabric.

Rooting deeply, and forming a dense short turf, the Sheep's Fescue is admirably adapted for lawns, bowling-greens, and pleasure-grounds; as it requires little mowing, resists the intrusion of most weeds, and in open situations retains its verdure throughout the summer, even in seasons when long-continued drought destroys most other vegetation. The preference manifested by gardeners, in forming grass-plots and edgings, for turf cut from the heaths and commons, is due to the presence of this grass in such places, and the fineness and shortness of its foliage.

The four following plants of the section are possibly only varieties of *F. ovina*, and are indeed regarded as such by most practical botanists who have bestowed much attention on their differential characters; these are so slight, as in most instances to leave little room for doubt upon the subject, but, being permanent under cultivation, their presentation in the work before us is almost a matter of necessity.

FESTUCA VIVIPARA. Viviparous Fescue Grass. PLATE LXXXVI.

Festuca ovina, var. vivipara of botanists generally. Festuca vivipara, *Smith. E. B.* 1355.

An evident variety of *F. ovina* or *F. duriuscula*, common in mountainous districts, especially those which present the loftiest peaks and summits. Its peculiarity consists in the substitution of small plants for flowers; the palcæ of the latter, and not unfrequently the stamens and ovary, being extended and forming leaves. The absence of seed, under these circumstances, is compensated by the distribution of the little plants thus produced, which eventually dropping off are wafted away by the wind and root where they fall.

Many of the earlier botanists seem to have entertained doubts concerning the identity of this grass with the common Sheep's Fescue, on account of the permanence of its viviparous character. This is retained in all situations, and under every mode of cultivation to which it may be subjected. Twenty years of garden growth and varied treatment, have not elicited any change in the aspect of plants originally raised from a panicle sent by post from the Highlands of Scotland. Wherever I have met with it in the wild state, it has been of taller growth than its supposed progenitor, and with leaves considerably longer and less rigid; but in the absence of fully developed flowers no distinction of species can be admitted between them.

FESTUCA CÆSIA. Glaucous Fescue Grass. PLATE LXXXVII.

Panicle ovate, one-sided, rather lax. Whole plant glaucous. Leaves all filiform.

Festuca cæsia, *Smith*. *E. B.* 1917. Festuca ovina, var., *E. B.* ed. 2. Authors generally.

Comparatively rare. From the very marked glaucous hue that generally characterises this grass, most ordinary observers would regard it as very distinct from the true Sheep's Fescue; but, apart from this hue and the lighter colour, and, usually, greater breadth of the panicle, there is really no feature by which they can be separated.

It is a very ornamental grass in gardens, especially among rock-work, as it forms dense tufts, and the blueish glaucous foliage contrasts brightly with the light lively green of most alpine plants.

Festuca duriuscula. Hard Fescue Grass. Tall Sheep's Fescue Grass. Plate LXXXVIII.

Panicle pyramidal, one-sided, branches spreading. Radical leaves filiform, channelled, stem leaves flat, acute. Root fibrous.

Festuca duriuscula, *Linnæus*. *Smith*. *E. B.* 470; ed. 2. 142. *Parnell*. Festuca ovina, var. duriuscula, *Babington*. *Hooker and Arnott*. *Bentham*.

Common; and often abundant in moist pastures and old meadows, where it attains a foot or more in height. Stems round, except at the upper part, stouter than those of most forms of *F. ovina*. Radical leaves tufted, in moist rich soil frequently equalling the flower-stems in length, slender, but not bristle-like; those of the stem usually expanded. Inflorescence from two to four inches long; the lower branches of the panicle longer, so as to give it a pyramidal, rather than an ovate outline. Spikelets five- to seven-flowered.

Perennial. Flowers in June.

This is generally regarded as one of our most valuable grasses, being very productive, considering the slender character of its foliage, and thriving in most soils and situations, from an elevation of two or three thousand feet to lands little above the sea-level. Mr. Sinclair remarks that "it withstands the effects of severe dry weather better than many other grasses;" and hence he recommends its use, in limited proportion, in laying down new pastures, adding that "it attains the greatest perfection when combined with *Festuca pratensis* and *Poa trivialis*." Few grasses retain their verdure during the severest winter weather to an extent so remarkable, a circumstance associated with its later and earlier growth compared with most of its associates. The spring produce, however, is but trifling, the foliage not attaining much length until the approach of the flowering season. Meadows in which it abounds should be mown when it is in flower, as not only is the bulk of the produce greater at that time, but likewise the proportion of nutritive matter.

Cattle generally are partial to the Tall Fescue Grass; and hares are remarkably fond of it, a circumstance deserving attention in forming

new game preserves, though it is usually abundant about woods and thickets in places where the ground has lain long undisturbed. Growing under the shade of trees or shrubs, it assumes a somewhat different habit, the panicle being smaller and more compact, and the spikelets downy; in this state it is probably *Festuca dumetorum* of Linnæus, a grass regarded by English agricultural writers as of inferior quality, though sheep, hares, and rabbits, do not appear to make any distinction.

FESTUCA RUBRA. Purple Fescue Grass. Creeping Fescue Grass.
PLATE LXXXIX.

Panicle oblong, one-sided, more or less spreading. Leaves downy on the upper side; those of the stem sometimes involute. Root sending out scions.

Festuca rubra, *Linnæus. Smith. E. B.* 2056; ed. 2. 143. *Babington*, Manual. Festuca duriuscula, var. rubra, *Parnell.* Festuca ovina, var. rubra, *Hooker and Arnott.* Festuca ovina, var. sabulicola, Sand Fescue Grass, *Bentham.*

Not unfrequent in dry sandy ground, especially near the sea; more rarely in inland and moist pastures. I believe that the alpine and submountainous habitats mentioned by the earlier English writers refer to purplish-hued states of *Festuca duriuscula*, or even of *F. ovina*, as an exception is sometimes made in their descriptions to the creeping habit, the most constant, and perhaps only important, character of distinction between this plant and the preceding. The true Purple Fescue is not a variable grass, unless in size, and attains its greatest development in the loose sand that accumulates on the sea-shore, which it contributes to bind and fix. The scions, or creeping stems, often extend to a considerable length, terminating in erect shoots with distichous leaves. The flowering stems occasionally rise to the height of two feet, being more or less unequally angular, and bearing four or five flat, or, rarely, partly involute leaves, which are downy on their upper side. The panicle has almost universally a reddish-purple hue, and the spikelets are larger than those of *F. duriuscula.* In other respects it so nearly approaches the latter, that, under existing views concerning specific distinction, their separation is based upon very equivocal grounds.

Perennial. Flowers in June and July.

As all stoloniferous grasses are considered to be impoverishing to the soil, the Creeping Fescue may be left by the farmer where Nature requires it for her own purposes. In regard to nutritive properties, it is said to be very inferior to all the grasses of this section.

The subjects of the five foregoing figures being considered by some botanists as forms of the same specific type, and all of them unques-

tionably nearly allied, some few remarks upon their differential characters are necessary. Adopting only those derived from the flower, a plan which deference to long habit has rendered all but peremptory in botanical science, the structure of the spikelets in the entire series is so strikingly similar, that, apart from proportion, pubescence, and other accidental circumstances, no plausible pretext could be found for their separation. Such separation then can only be established by reference to features usually considered beyond the pale of floral orthodoxy; the value, however, of some of these which are intimately associated with plant life, and distribution, cannot be disputed, even by the most rigid disciples of the species-condensing school, of which, as in p. 73 of the present work, I have already confessed myself a member. It is upon some such features that my belief is founded of an actual specific distinction existing between two at least of the grasses now before us. Cultivated for many years, and raised occasionally from seed, they all maintain their original characters without the slightest deviation being produced by difference of soil and situation; and admitting *F. vivipara* to be an understood variety of one of the others, and the possibility that *F. cæsia* may bear the same position with regard to *F. ovina*, which I doubt, *F. duriuscula* and *F. rubra* still remain with a difference of habit so marked as to render their supposed identity with the typical species of this section incompatible. The stouter rounded stems and broader channelled, not bristle-like, leaves of the Tall Fescue Grass, the pyramidal form of its larger and looser panicle, are constant features of distinction between them. In regard to *F. rubra*, its stoloniferous character affords very positive ground for retaining it as a species, though misled by an occasional tendency in *F. duriuscula* to produce, in light soils, weak root shoots, some botanists have confounded them. Had these latter witnessed the pertinacity with which the scions of the Purple Fescue, properly so called, are extended in the hardest ground and beneath their garden walks, they would possibly be of a different opinion. The general aspect of the two plants is otherwise about as dissimilar as can well be conceived.

All the specimens I have met with of *F. vivipara* appear to belong to *F. duriuscula* rather than to *F. ovina*, and are very unlike the long-leaved variety of that species found in the Highlands of Scotland, *F. tenuifolia*, of Sibthorpe. This last grass is figured by Dr. Parnell, plate 57 of his 'Grasses of Scotland,' under the name of *angustifolia;* the absence of awn at the extremity of the palea formerly led to the supposition that it might be a distinct species; the opportunity of making it such is, however, allowed to pass by modern writers, and, as apart from the non-development of a terminal hair, length of leaf is the only characteristic, the bare notice of its existence is sufficient.

*** Radical leaves flat, broader than those of the culm. Awn absent, or arising from below the summit of the outer palea, never terminal. Ligule of the uppermost leaf prominent, obtuse. Outer palea three-veined.

Schedonorous—Palisot de Beauvois.

FESTUCA SYLVATICA. Reed Fescue Grass. PLATE XC.

Panicle repeatedly branched, spreading, erect. Spikelets oblong, of three to five awnless acute flowers. Lower palea scabrous, three-veined, the middle vein serrulate. Leaves lanceolate-linear with scabrous margins.

Festuca sylvatica, *Villars. Hooker and Arnott. Babington. Bentham.* Festuca Calamaria, *Smith. E. B.* 1005; ed. 2. 147. Schedonorous sylvaticus, *Beauvois. Lindley.* Poa sylvatica, *Parnell.*

Far from unfrequent in mountainous and rocky woods in the north-west parts of England, the southern and middle counties of Scotland, and in Ireland, growing chiefly in places retentive of moisture. It is found in similar situations throughout central Europe. It forms coarse reed-like tufts, having a tendency to spread by creeping. Stems erect, round, roughish, slender, sometimes three or four feet high. Leaves broad, flat, tapering to a point, very long, roughish on both sides. Ligule, prominent, obtuse. The lower part of the flower-stems is always clothed with imbricated, broad, acute scales, of a brown colour, and more or less glossy. Panicle four to six inches long, occasionally slightly drooping at the extremity; its branches spread widely when in flower. Spikelets distant, rarely less than three- or four-flowered. Lower or outer palea very acute, the middle vein rarely extending beyond its termination; the inner palea about equal in length, folded along the middle, minutely fringed on the margins.

Perennial. Flowers in July.

The above synonyms indicate the varied opinions of botanists concerning this species, as well as the uncertainty in which the whole genus *Festuca* is involved.

Cows and horses will eat the leaves of the Reed or Wood Fescue Grass, especially in the early part of the year while they are soft and tender; but though the produce is most abundant, in the condition of hay it is worthless, and otherwise unworthy the attention of the agriculturist.

FESTUCA DECIDUA. Deciduous Fescue Grass. PLATE XCI.

A mere variety of *Festuca sylvatica*, with narrower leaves and the spikelets usually only two-flowered.

I am only acquainted with this grass through the figure and description in 'English Botany,' tab. 2266, and a single dried specimen, from neither of which does it appear to differ essentially from the preceding. The habit, however, is sufficiently varied to warrant the republication of that figure as a guide to future observers.

**** Radical leaves flat, broader than those of the culm. Awn absent, or arising from below the summit of the outer palea. Ligule of the uppermost leaf very short, or obsolete. Outer palea five-veined.

Bucetum—Parnell.

FESTUCA PRATENSIS. Meadow Fescue Grass. PLATE XCII.

Panicle simple, nearly erect, more or less spreading or compact. Spikelets oval-lanceolate, compressed, many-flowered. Lower palea five-veined, the middle vein terminating below the apex in a very short or obsolete awn. Leaves linear-lanceolate.

Festuca pratensis, *Hudson*. *E. B.* 1592; ed. 2. 148. Most modern botanists. Bucetum pratense, *Parnell*. Schedonorus pratensis, *Beauvois*. *Lindley*.

A very common grass in moist meadows and pastures throughout the kingdom, and extending naturally over Europe and northern Asia, except within the limit of perpetual frost in the latter. Stems one or two feet high, erect, round, smooth, striated. Leaves linear-lanceolate, acute, flat, roughish on the inner or upper face. Panicle branches simple, sometimes bearing only a single stalked spikelet. Spikelets ovate-lanceolate or oblong, bearing five or six, or a greater number, of fertile flowers. Outer palea frequently bifid at the extremity, which is membranaceous; the veins not extending into the cleft portion, though the central one of the five occasionally protrudes at the base of the latter as a very short rough awn.

Perennial. Flowers towards the end of June.

The valuable properties of this grass for agricultural purposes have been long recognised. It was one of the six (*Anthoxanthum odoratum*, *Alopecurus pratensis*, *Poa pratensis*, *Poa trivialis*, *Cynosurus cristatus*, and *Festuca pratensis*) that were especially recommended by Curtis, beyond all others, for laying down meadows and pastures on moist or moderately dry soils; and though modern practice and experience might lead to a partial alteration in the list, the species before us would still hold its place. The Woburn experiments were greatly in its favour, and the observations of most of our best agriculturists confirm their results. Mr. Sinclair, after calling attention to the fact that the Meadow Fescue Grass is one of those that contribute most abundantly to the herbage of all rich natural pastures and irrigated meadows, state that "it makes excellent hay, and, though a large plant, the leaves are succulent and tender, and apparently much liked by cattle, as they never form rank tufts, which is the case with most of the larger grasses. It does not appear to arrive at its full productive powers from seed so soon as either the Cocks-foot or Fox-tail grass; and, though essential for permanent pasture, is not by itself very well adapted for alternate husbandry, but should be combined with Cocks-foot, Rye-grass, and Rough-stalked Meadow-grass. It is of greater value at the time of flowering than when the seeds are ripe, in the proportion of three to one. In the deep alluvial soils of Lincolushire, this grass is not so prevalent as in the clay districts. In the Vale of Aylesbury it constitutes a considerable portion of the most valuable and fattening pastures of that rich grazing district." Another writer, Mr. Salisbury, remarks that "if land intended for meadow could be

laid down with one bushel of *Festuca pratensis*, one of *Alopecurus pratensis*, three pounds of *Anthoxanthum*, a little *Bromus mollis*, with White Clover, the farmer will seek no further." No species among our native grasses, *Alopecurus pratensis* excepted, produces so great a quantity of early food as the Meadow Fescue Grass, and it appears to be far superior to the latter in nutritive qualities.

FESTUCA ELATIOR. Tall Fescue Grass. PLATE XCIII.

Panicle much branched, spreading, inclining to one side; branches mostly in pairs, divaricated after flowering. Spikelets many-flowered, ovate-lanceolate. Lower palea five-veined; the middle vein terminating below the apex in a short awn. Leaves linear-lanceolate.

Festuca elatior, *Linnæus. E. B.* 1593; ed. 2. 149. *Hooker and Arnott. Bentham.* Festuca arundinacea, *Schreber. Babington.* Schedonorus elatior, *Beauvois. Lindley.* Bucetum elatior, *Parnell.*

Not unfrequent in wet meadows, especially in a stiff clayey soil liable to occasional overflowings, likewise in osier-grounds, sea-marshes, and moist woods. It has often a reed-like aspect, growing in large tufts, the round, erect, striated stems varying in height from three to five feet. Leaves linear, acute, or almost linear-lanceolate, scabrous above, especially towards the extremity. Panicle large, sometimes a foot or more in length, spreading widely, and somewhat inclining to one side; the principal branches much divaricated, and even bending downwards after flowering. Spikelets ovate-lanceolate, varying in the number of flowers from five or six upwards. Outer palea five-veined, the middle or dorsal vein terminating in a short rough awn below the membranaceous and frequently bifid apex.

Perennial. Flowers in June and July.

The habit of this grass is not at all prepossessing to the eye of the farmer, being coarse and rank, but cattle are fond of it, cows especially; while, almost equally productive with *Festuca pratensis*, it is said to surpass it in nutritive quality. Hence it might prove a useful grass in situations not adapted to the growth of the more manageable species.

The Tall Fescue Grass is liable to variation in the form and divarication of the panicle, a circumstance that seems to have led some of our most intelligent practical botanists to suspect there may be two species confounded under this name, viz. *F. arundinacea* of Schreber, and *F. elatior* of Linnæus. I have had no opportunity of ascertaining to what extent this view may be supported by facts, but, unless such specific difference is marked by features of greater constancy than those above mentioned, must demur even to the highest authority in such matters; having seen both the sea-side and the inland plant assuming in alternate seasons, wetter or drier, an arrangement of the branches of the inflorescence, so dissimilar, that, in herbarium speci-

menus, they might easily pass as confirmed varieties if not as distinct species.

It will be observed, on comparison of the descriptions of the Meadow and the Tall Fescues, that they approach very closely to each other, habit or general aspect being the chief distinction between them. Independent, however, of the greater height of the one before us, its leaves are twice the size of those of *F. pratensis*, from which it further differs in having a much more branched panicle, which spreads more equally in all directions, and is less erect in the mass; the spikelets too are less compressed, and the flowers more constant and distinctly awned. The importance attaching to such distinctions, may, on the broad scale, be somewhat equivocal, and this is evidently the view of Mr. Bentham, who considers *F. pratensis* a variety of *F. elatior*. I am almost inclined to agree with him.

FESTUCA GIGANTEA. Tall Bearded Fescue Grass. PLATE XCIV.

Panicle branched, drooping. Spikelets lanceolate, compressed, about five- or six-flowered. Lower palea five-veined; the middle vein terminating below the apex in a scabrous awn much longer than the palea. Leaves linear-lanceolate, ribbed.

Festuca gigantea, *Villars*. *E. B.* 1820; ed. 2. 146. *Hooker and Arnott*. *Babington*. Bucetum giganteum, *Parnell*. Bromus giganteus, *Linnæus*. *Hooker*. *Bentham*.

Not unfrequent in moist woods and thickets, especially where the ground is well shaded, and not much affected by the summer drought. It is somewhat inclined to creep at the root. The round, striated stems grow to the height of three or four feet. The leaves are very long, broad, and more or less strongly ribbed; rough on both sides, except near the base on the outer surface. Ligule unequal, auricled. Inflorescence often very much branched, loose, and drooping towards one side, the lower branches growing generally in pairs upon the rough rachis. Spikelets lanceolate, or inclining to ovate, pointed, compressed; usually consisting of five or six flowers. The outer palea is more or less distinctly five-veined, the four lateral veins all terminating below the apex, which is membranaceous and usually bifid; the middle vein extends below the cleft into a strong, rough awn, considerably longer than the palea, a character by which this grass is at once distinguishable from others belonging to this section of the genus *Festuca*.

Perennial. Flowers towards the end of July.

It is a coarse grass and of no agricultural value, as it dwindles in size and becomes more rigid when cultivated in open ground, and, though eaten by cattle in default of more grateful and palatable herbage, is deficient in the elements of nutrition. Horses and cows will often reject hay in which it is mingled. The seeds afford food to many of the smaller birds.

The Giant, or Tall Bearded Fescue Grass, has very much of the habit of the grasses belonging to the genus *Bromus*, to which it was formerly, and is still by some botanists assigned. The shortness of the ligule, and the attachment of the styles or stigmas to the summit of the ovary, are the leading features of distinction.

FESTUCA TRIFLORA. Three-flowered Bearded Fescue Grass. PLATE XCV.

An occasional form of the preceding, of smaller size, with a less luxuriant and nearly erect panicle, and the spikelets seldom more than two- or three-flowered.

Festuca triflora, *Smith. E. B.* 1918. Festuca gigantea, var. *E. B.* ed. 2. 146*, and of most English botanists. Bromus triflorus, *Linnæus.*

Occasionally met with in comparatively dry and barren ground, and about sandy sea-shores. The habit is so different from that of *F. gigantea*, that at first sight it might be regarded as a distinct species, even by one accustomed to botanical pursuits.

FESTUCA LOLIACEA. Spiked Fescue Grass. PLATE XCVI.

Panicle spike-like. Spikelets solitary, distichous, nearly sessile, linear-oval or oblong, six- to ten-flowered.

Festuca loliacea, *Hudson. E. B.* 1821; ed. 2. 150. Festuca pratensis var. loliacea, *Hooker and Arnott. Babington. Bentham*, Bucetum loliaceum, *Parnell.*

Frequent in moist meadows and pastures, especially in a rich soil. Stems one or two feet high. Leaves linear, acute, roughish on the upper surface, smooth beneath. Panicle three to six or eight inches in length; the rachis more or less flexuose, owing to the alternate disposition of the somewhat distant spikelets. Spikelets forming two opposite rows, or distichous, generally nearly sessile, though the lowermost are often supported by short stalks; linear-oval, acute; seldom less than about six-flowered. Glumes very unequal, the inner or upper one being sometimes all but obsolete. The length of the spikelets is liable to great variation, and with it the number of flowers, which occasionally extends to twelve or fourteen. The outer palea is membranaceous at the apex and obtuse; it is five-veined, the veins terminating as in *Festuca pratensis* below the summit, but the middle vein never extends as a dorsal awn.

Perennial. Flowers in July.

This grass is very liable to be overlooked, from its near resemblance in habit to the more frequent and abundant *Lolium perenne*, Ray Grass, or Darnel, but that may be at once distinguished by the spikelets having only a single large glume externally, while the Spiked

Fescue is never altogether destitute of a smaller inner one likewise. There is much differenee of opinion respecting the claim of this latter to rank as a distinct species, most modern botanists being inclined to regard it a mere variety of *Festuca pratensis* with sessile or but slightly stalked spikelets, the structural resemblance to that species having been long acknowledged, and specimens of an intermediate character being far from unfrequent. It is placed here, at the conclusion of the series, instead of occupying the position it ought to have were this view correct; because my own opinion accords with that of the Rev. G. Swayne, as quoted by Withering in his 'Arrangement of British Plants,' who thus writes:—"Admiring the appearance of this grass when it first occurred to me, I transplanted some roots into my garden. The same season I fenced round with hurdles a considerable patch of it, which I found growing in a close in my own occupation, with a view to save the seed. But when I came to gather it, I was much disappointed, not finding a single seed in any of the spikes. Supposing this might have been owing to accident, I increased what I had in my garden till it occupied a plat of six feet square. It grew well, and produced a full crop of flowering spikes. The stamens were apparently perfect, and shed a large quantity of pollen, and the pistils were protruded and expanded, as if in a state fit to receive impregnation, but not a single seed was formed. This has been its annual process for a number of years." All who have made the Spiked Fescue Grass the subject of experiment since Swayne wrote, concur in recording its tendency to infertility, and although a few seeds are occasionally produced, in meadow specimens, which have the appearance of being perfect, they are seldom, if ever, found to vegetate. The author of the above remarks, considering such constant barrenness a certain criterion of hybridity, proposed to call it *Festuca hybrida*, and imputed its origin to intercourse between *F. pratensis* and *Lolium perenne*, a conclusion which I believe to be correct, though unable at present to certify.

From the Woburn experiments it appears to be far superior to Ray Grass for the purposes either of hay or permanent pasture, as the crop is not only larger in proportion but the produce durable, instead of diminishing, as where the latter grass is concerned, year after year. To the practical farmer it cannot, however, as a seedless grass, be deserving of notice.

Genus 36. BROMUS. Brome Grass.

Gen. Char. Inflorescence paniculate, generally loose and spreading. Spikelets many-flowered, more or less laterally compressed. Glumes two, unequal, more or less carinate, not longer than the lowermost flowers. Paleæ two, herbaceous; the external one awned below the bifid apex; the inner one ciliated on the veins. Styles inserted below the apex of the ovary.

The genus is a large one, comprising sixty or seventy species, distributed principally over the northern hemisphere, and almost

exclusively in Europe and Asia. They are, for the most part, grasses of a rough quality, disliked by cattle generally, and containing little nutriment; hence, in an agricultural point of view, they may be regarded as mere weeds, and, in the still too frequent promiscuous collection of grass seed by the farmer, that from meadows in which any of the species of Brome Grass are abundant should be systematically avoided. Most of the plants, and especially those occupying fields and open situations, are annuals; and though, cut early in the season, *Bromus mollis* and a few others yield a quantity of coarse hay, there is no after math.

The name is from the Greek *bromos*, a kind of oat; from *broma*, food, and is certainly misapplied to the genus before us, many of the species of which are decidedly unwholesome.

The ripe seed (fruit) is hairy at the apex, and coheres, in most instances, with the upper or inner palea.

The genus *Bromus* of Linnæus is divided by some modern botanists, but as the differential characters appear insufficient for the establishment of a new genus, it is here retained entire, so far as the name is concerned. The two sections under which the British species are arranged below, still correspond to the *Bromus* and *Serrafalcus* of Mr. Babington's Manual.

* Lower glume single-veined, upper one three- to five-veined. Flowers lanceolate, compressed.

Bromus.

BROMUS ERECTUS. Upright Brome Grass. PLATE XCVII.

Panicle erect; its branches nearly simple. Spikelets linear-lanceolate, erect. Flowers remote, sub-cylindrical, longer than the straight awn. Lower palea obscurely seven-veined. Radical leaves convolute, ciliated, with white scattered hairs pointing upward.

Bromus erectus, *Hudson*. *E. B.* 471; ed. 2. 157. Generally adopted.

This may be regarded as a very local species, being almost exclusively confined to dry sandy soil, overlying chalk, hence not unfrequent in the southern and eastern counties of England, while it is of rare occurrence in other parts of the kingdom. It is met with in similar localities in central and southern Europe, extending into the lower parts of Norway and Sweden. A strong growing plant, slightly creeping at the root, and sending up erect, smooth, and sometimes almost polished stems, two or three feet high. The root leaves are narrower than in most other species of this genus, and appear more slender than they really are from being rolled in on the margins; they are rough to the touch, especially towards the apex, and always more or less copiously sprinkled with white scattered hairs that point upwards. The stem leaves are broader and flat, and have a short, obtuse ligule, torn or broken at the upper part. Inflorescence usually simply panicled, three to six inches long, nearly erect, and rather compact. Spikelets

comparatively few, varying from half-an-inch to more than an inch in length, and bearing on the average seven to nine flowers. Flowers rather distant, diverging as they expand, so as to give a lax character to the spikelet, in lieu of the compact form which distinguishes it before and afterwards. Glumes often nearly equal, the upper one the larger, and distinctly three-veined. Outer palea seven-veined, four of the veins indistinct; the middle or dorsal one terminating below the membranaceous bifid extremity of the palea, in a straight rough awn about half the length of the latter. Inner palea with two green marginal fringed veins. The flowers have frequently a tinge of purple.

Perennial. Flowers in June and July.

It seems to be universally rejected by cattle, but pheasants are said to be fond of the seeds.

Two varieties are noticed by botanical collectors, one having the culm or flowering stem smooth, as above described, the other both that and the spikelets hairy.

In habit this grass differs from most of the other Bromes, and the authors of the 'British Flora' compare it to *Brachypodium sylvaticum;* the resemblance is not, however, at all striking.

BROMUS ASPER. Hairy Wood Brome Grass. PLATE XCVIII.

Panicle drooping; branches long, more or less divided. Spikelets linear-lanceolate, drooping. Flowers remote, sub-cylindrical, longer than the straight awn. Lower palea hairy, five- or seven-veined. Leaf-sheaths hairy, the hairs pointing downwards. Leaves uniform.

Bromus asper, *Linnæus. E. B.* 1172; ed. 2. 158. Generally adopted.

Not unfrequent in moist woods and thickets, but rarely intruding upon more open ground. A large, coarse grass, with strong roughish stems that often attain a height of five or six feet, far overtopping the ferns and brambles among which they grow. Unlike those of the preceding species, the radical leaves are broad and flat, resembling those of the stem, and, indeed, proportionally larger; they are less copiously hairy, and the hairs, especially on the sheaths, have a different direction, pointing downwards instead of upwards. The panicle is widely spreading and drooping to one side; the weight of the large spikelets, and the length and slenderness of their supporting branches, causing them to become pendulous after flowering. Spikelets comparatively few, about an inch long, eight- or ten-flowered, much resembling those of the last, and like them spreading with the expansion of the rather distant flowers, but contracted both before and afterwards. Glumes very unequal, the upper one longest, distinctly three-veined. Outer palea hairy, five-veined, membranaceous and bifid at the apex, below which the middle vein separates from it, and extends, in the form of a straight rough awn, about half the length of the palea. Marginal veins of the inner palea ciliated.

Annual or biennial. Flowers in July.

The only indigenous species of Brome Grass, with which this species is likely to be confounded by an ordinary observer, is *Bromus sterilis*, the next described, and that only where dwarf specimens of the former, and exaggerated ones of the latter, growing in similar localities, are concerned; in such cases, the hairy character of the outer palea, and the short awn of *B. asper*, form a strong contrast to the smooth flowers and lengthened awn of the Barren Brome Grass.

Dr. Parnell remarks that "horses and cows eat it in common with other grasses of the wood, but they give the preference to pasture grass, except in cases of necessity, when quantity is of greater consideration than quality." When growing on the edges of woods bordering pasture land, the early foliage, being succulent and sweet, is generally cropped pretty closely in spring—but this is one of the least palatable of its kind.

BROMUS STERILIS. Barren Brome Grass. PLATE ~~CXIX~~ XC IX.

Panicle drooping; branches elongated, more or less divided or simple. Spikelets linear-lanceolate, drooping. Flowers remote, sub-cylindrical, much shorter than the straight awn. Lower palea smooth, with seven distinct equi-distant veins. Leaves pubescent.

Bromus sterilis, *Linnæus*. *E. B.* 1030; ed. 2. 159. Generally adopted.

Common throughout the kingdom, and widely distributed over Europe and Russian Asia, except in the colder regions of the extreme north, and in mountainous districts. Its favourite habitats in this country are dry and rather sheltered waste places, road-sides, and hedge-banks; and it rarely intrudes into the open meadows and pastures, unless in very dry and barren, gravelly, or sandy soil, of which its presence in any quantity may, indeed, generally be considered indicative, while the specific name *sterilis* seems to have originated from the same circumstance. Although the root is only annual, the stems being procumbent at the lower part, and rooting where the lower joints rest against the ground, this grass may be said to have a creeping habit. At the flowering season the stems attain the height of from one to two feet, or, in woods, and shady and rather moist situations, sometimes more; they are roughish and striated. The leaves are broad and flat, usually of a dark green colour, and more or less rough and pubescent. Panicle distantly branched, drooping and spreading; with long, slender, rough, and mostly simple branches. Spikelets long, lanceolate, or linear-lanceolate; including the awns frequently more than two inches in length; about eight-flowered. Glumes very unequal, the upper one three-veined. Outer palea seven-veined, not hairy; the veins equi-distant. Awn more than twice the length of the palea. Inner palea about one-third shorter than the outer; its two green marginal veins ciliated.

Annual. Flowers in June and July.

An elegant grass, seldom eaten by cattle, but valuable in nature as a colonizer.

BROMUS DIANDRUS. Upright Annual Brome Grass. PLATE C.

Panicle erect; branches short, generally simple, rather spreading. Spikelets lanceolate or linear-lanceolate, erect. Flowers remote, subcylindrical, about the length of the awn. Lower palea seven-veined; the two outer veins on each side close together, and the intermediate ones indistinct. Often diandrous.

Bromus diandrus, *Curtis. E. B.* 1006; ed. 2. 160. Generally adopted by modern British botanists. Bromus madritensis, *Linnæus. Bentham.* B. muralis, *Hudson.*

A grass of occasional occurrence only in this country, and chiefly in the southern counties of England. It seems to prefer dry sandy places, and rocks and walls near the sea, especially about the borders of the English Channel, though said to have been found northward in Durham, about Edinburgh, and on the coast of Fifeshire. Although noticed by Hudson, Withering, and other earlier English botanists, it cannot be regarded as strictly indigenous, but rather as a natural introduction from the south of Europe or the Atlantic Islands. It varies much in size, according to situation, the smooth, erect stems rising from a few inches to a foot or more in height. The leaves are linear, acute, and more or less hairy or downy, and the hairs on the leaf-sheaths are reflexed or pointing downwards. Panicle with simple branches or raceme-like; the branches erect and close, or but very slightly spreading, and rarely as long as the spikelets they support. Glumes very unequal, the upper and larger one three-veined. Spikelets eight- or ten-flowered, spreading by the expansion of the flowers, so as to lose their original lanceolate outline. Flowers rather distant on the rachis. Outer palea scarcely shorter than its straight rough awn; seven-veined, the two outer veins on each side near to each other, the intermediate one on either side the middle vein usually very faint and indistinct. Inner palea scarcely shorter than the outer, its two green marginal veins ciliated. The flowers have often a purplish tint.

Annual. Flowers in June and July.

The erect, close, shortly-branched panicle, comparitively short awn, only equalling the palea in length, and the peculiar arrangement of the veins of the outer palea, render the species very distinct from those to which it is most nearly allied, especially *B. sterilis.*

It has no claim to consideration as a pasture grass.

Bromus rigidus, Roth; found in the Channel Islands, and, on at least one occasion, near the Land's-end, Cornwall, resembles this in the general character of the panicle, but has the upper part of the stem, the pedicels, rachis, and glumes pubescent.

Bromus tectorem, another continental Brome Grass, met with a few years past growing near the new mill at Hoddesdon, Hertfordshire, is referred to by the authors of the 'British Flora,' as "principally distinguished from this by the unilateral drooping panicle, and by having the outer palea much longer than the inner one." I have not

seen English specimens, but consider its claim to rank as a separate species equal to that of *B. diandrus* itself. As a merely accidental introduction it is not entitled to a place among British grasses. It is a weed of no economical value.

BROMUS MAXIMUS. Great Brome Grass. PLATE CI.

Panicle erect, lax, at length nodding. Spikelets lanceolate, downy; their stalks elongated after flowering. Flowers remote, sub-cylindrical, about half the length of the awn. Lower palea seven-veined. Leaves downy on both sides.

Bromus maximus, *Desfontaines. Babington. E. B.* Supp. 2820. Generally adopted.

A native of sandy places near the sea, around the basin of the Mediterranean, from which it seems to have originally extended northward along the Atlantic shores of Spain and France to the Channel Islands, where Mr. Babington first directed to it the attention of British botanists, as growing on the sands of St. Aubin's Bay, the Grève d'Azette, the Quenvais, and other places in Jersey. It is an elegant grass, sending up erect stems, in tufts, to the height only of one or two feet, notwithstanding the name *maximus*, which, as bestowed by the author of the 'Flora Atlantica,' probably refers rather to the African than to the European stature and habit of the plant. The stems are downy at the upper part above the leaf-sheaths, which are striated, and more or less hairy. The leaves, downy on both sides, are flat, linear-acute. The panicle is usually simple, but occasionally one or two of the lower branches are divided; it is at first erect, but, as the flowering season advances, becomes slightly curved forward at the upper part, nodding rather than drooping. The rachis and peduncles are downy, but not rough. Spikelets expanding, lanceolate, including the awns often between three and four inches long. Glumes so much attenuated as almost to appear awned, the upper one larger, five-veined. Outer palea with seven prominent, rough, equi-distant veins, membranaceous, and glossy on the margins; its awn very variable in length, but usually exceeding it two or three times. Inner palea much shorter than the outer. Stamens frequently only two.

Annual. Flowers in June and July.

Should this grass be considered to approach *Bromus diandrus*, the distinction between them may be said to consist in the more lax form of inflorescence in the present, the greater proportionate length of the awns, the inequality of the paleæ, and the equi-distant arrangement and prominence of the seven veins of the outer one. The resemblance between it and *B. sterilis* is much less easily overcome, and I fear that the difference between roughness and downiness of the rachis and peduncles, and the proportionate lengths of the lowermost flower of a spikelet and the larger glume, will not much assist our decision in the matter. Dr. Parnell has endeavoured to obviate the difficulty by

drawing attention to the fact, that a "peculiar, sharp, conical point at the base of the flowers will readily distinguish *Bromus maximus* from all the other species of British *Bromi*." As this remark has been quoted by other authors it is here appended, although the value of the feature indicated is questionable; the "conical point" being only a rudimentary pedicel, not an unfrequent adjunct to the bases of grass flowers, and, though possibly constant in its presence in this instance, too frequently the result of accidental development to have much importance in deciding specific separation.

** Outer glume three- to five-veined; inner one seven- to nine-veined. Flowers oblong, turgid.

Serrafalcus, *Parlatore*. *Babington*.

† Outer palea seven-veined.

BROMUS SECALINUS. Smooth Rye Brome Grass. PLATE CII.

Panicle loose, drooping when in fruit; lower peduncles more or less branched. Spikelets ovate-oblong, compressed, smooth. Flowers at first imbricated, afterwards distinct, cylindrical, about the length of their awns.

Bromus secalinus, *Linnæus*. *E. B.* 1171; ed. 2. 151. *Smith*. *Hooker and Taylor*. *Parnell*. B. arvensis, var., *Bentham*. Serrafalcus secalinus, *Babington*.

Not unfrequent in corn-fields, where its smooth, round, striated stems usually rise to about the height of the crop. Leaves flat, rather broad, roughish at the edges and underneath, but downy and soft above, sharply pointed. Inflorescence at first erect, but more or less drooping, after flowering, with the increasing weight of the seeds. Panicle often simple, but more frequently having one or two of the lowermost peduncles branched. Spikelets, ovate, glossy, eight- to ten-flowered. Glumes broad, nearly equal; the outer smaller, three-veined; the inner seven-veined. Flowers spreading and separating as the fruit begins to enlarge. Outer palea about the length of its straight or slightly wavy awn.

Annual. Flowers from July to September.

A troublesome weed in arable land, especially among wheat and rye, and one that ought to be carefully eradicated before the approach of the flowering season. This might be easily done, the foliage of the grass being so dissimilar in aspect to that of the legitimate crop as to be distinguished at a glance, and the labour would be well repaid. Not only does the abundant production of the large seeds of the Rye Brome Grass tend greatly to exhaust the soil, but, where present in any quantity, they much deteriorate the value of the grain, by ripening about the same time, and thus becoming mingled with it when threshed. The occasional bitterness of both wheat and rye flour is generally due to such admixture; and the bread made from it is not only unpalatable

but unwholesome, as the seeds of this and other brome grasses of the section have a narcotic quality approaching that of the Darnel, see *Lolium temulentum*. This effect has been long known in Sweden, in the southern provinces of which it is so common among the rye, that it was supposed to be a degenerate form of that grain, an idea that still prevails among the uneducated country people in some parts of England. The panicles are employed in the south of Sweden for dyeing green.

BROMUS VELUTINUS. Downy Rye Brome Grass. PLATE CIII.

Panicle spreading, nearly simple. Spikelets ovate, lanceolate, downy; ten- to fifteen flowered. Flowers compactly imbricated, elliptical, about the length of their awns.

Bromus velatinus, *Smith. E. B.* ed. 2. 152. B. multiflorus, *E. B.* 1884. Bromus secalinus var. velutinus, *Parnell. Hooker and Arnott.* Serrafalcus secalinus var., *Babington*

First noticed in Britain, by Sir J. E. Smith, between Edinburgh and Newhaven; and since by other botanists, growing occasionally among corn in Surrey and elsewhere. Though generally now regarded as an accidental variety of the last species, its habit is so different as to render the contrast between them very striking. The spikelets are much more compact, broadly lanceolate, and consisting of a greater number of flowers; which latter are conspicuously downy, and do not separate eventually so as to show the rachis when in fruit, as do those of the normal *B. secalinus*. The value of such features is unimportant in distinguishing species, but the claim to be so considered, is about equal between it and its alleged type.

Annual. In flower in a wheat field, between Brixton and Tulse-hill, Surrey, about the end of June.

BROMUS COMMUTATUS. Tumid Field Brome Grass. PLATE CIV.

Panicle loose, slightly drooping, more or less branched. Spikelets linear, or oblong-lanceolate, smooth. Flowers loosely imbricated, about as long as the straight awn. Leaves and sheaths hairy.

Bromus commutatus. *Schrader. Parnell. Hooker and Arnott.* B. pratensis, *E. B.* 920. B. racemosus, *E. B.* ed. 2. 154*. Serrafalcus commutatus, *Babington.*

Frequent in corn-fields and waste places by road-sides, varying much in the height of its stems according to situation and the vegetation among which it grows. Stems smooth, finely striated. Leaves sharply pointed, soft and downy above, rough at the edges. Inflorescence more or less drooping; the panicle branches frequently much divided in large specimens, and spreading loosely, but in smaller

often quite simple, and almost erect Spikelets linear-lanceolate, or approaching to oblong, eight- or ten-flowered, smooth, or even glossy. Glumes usually nearly equal, but variable. Awn of the outer palea equal to it in length, straight or slightly waved.

Annual. Flowers in June and July.

Some modern botanical writers have bestowed much pains in attempting to prove this a distinct species; if it be such, it is a perfect vegetable proteus. However different may be my own views, I am unwilling to avoid acknowledgment of the industry and careful research by which others have arrived at a contrary conclusion; and hence transcribe a quotation from Mr. H. Watson's remarks on this subject, according to whom "this species is known by its glossy, grey-green spikelets acquiring a brownish tinge in sunny spots, its longer and harsher peduncles than those of *B. mollis*, and *racemosus*, and its glumellas (paleæ) larger and more inflated than in *B. secalinus* and *arvensis*." How far the value of such characters may be enhanced by the recorded fact that, in *Bromus commutatus* the apex of the upper glume reaches half-way to the top of the *fourth* flower of the spikelet, while in *Bromus mollis* and *B. racemosus* it extends half-way to the top of the *sixth* flower, is a question yet to be decided.

Dr. Parnell, noticing this grass, in the earlier part of his admirable work, under the name of *Bromus arvensis*, observes upon its attachment to richer soils than *B. mollis*, *B. racemosus*, or *B. secalinus*; and considers it of more value, as affording a considerable weight of nutritive hay, especially if cut at the time of flowering; but adds, that if left unmown until the seed is ripe, the crop becomes comparatively of no value. Its herbage in spring affording an early bite to sheep and lambs, constitutes its principal merit.

Bromus racemosus. Smooth Brome Grass. Plate CV.

Panicle rather compact, erect, usually simple. Spikelets ovate, more or less compressed, glossy. Flowers closely imbricated, about as long as the straight awn. Leaves and sheaths slightly hairy.

Bromus racemosus, *Linnæus. E. B.* 1079; ed. 2. 154. *Parnell. Hooker and Arnott.* Serrafalcus racemosus, *Babington.*

Perhaps not unfrequent in meadows and pastures, especially on a poor, sandy, or gravelly soil, though liable to be confounded with both the preceding and following. Stems slightly pubescent, from one to two feet in height. Leaves soft to the touch, except towards the point, rather downy than hairy. Inflorescence erect, even when in fruit; the rough and generally simple stalks of the panicle being rigid and directed upward. Spikelets ovate or ovate-oblong, light-green, glossy, six- to eight-flowered. Glumes broad, roughish. Awn about the length of the palea, or rather exceeding it.

Annual. Flowers in June and July.

Scarcely distinguishable from *B. commutatus* even as a variety, the

very slight differences in habit and minor features being utterly lost in intervening forms. In regard to value as a pasture grass, it is about equal to most others of its genus. The early foliage may be cropped by sheep and cattle, but it is of no account later in the season.

BROMUS MOLLIS. Soft Brome Grass. PLATE CVI.

Panicle erect, rather compact, more or less branched. Spikelets ovate, rather compressed, pubescent. Flowers closely imbricated, downy, about as long as the straight awn. Leaves and sheaths hairy or downy.

Bromus mollis, *Linnæus. E. B.* 1078; ed. 2. 153. *Parnell. Hooker and Arnott.* Serrafalcus mollis, *Babington.*

Common throughout the kingdom in almost all soils and situations, growing alike in meadows and pastures, and on banks and road-sides, and not unfrequently in corn-fields, to the impoverishment of both soil and crop. The whole plant is pubescent, and very soft to the touch, hence the specific name. It varies greatly in stature, according to situation and exposure, being often under a foot, while among corn it rises to two or three feet. Leaves soft, downy on both surfaces, but the edges are rough when drawn downward across the fingers. Inflorescence, unless in very small specimens, more or less compound, the branches of the panicle in either case being comparatively rough and hairy. Spikelets ovate or oblong, darkish green, variegated with the lighter-hued, or whitish margins of the paleæ, eight- or ten-flowered.

Annual. Flowers from the end of May to July.

Many variations are presented by this most common of the British Brome Grasses, but with one exception they do not seem to be permanent. This latter, *B. mollis, B. velutinus*, is found on the sandy shores of Cornwall and South Devonshire, and is chiefly remarkable for its densely pubescent character throughout; the panicle is always simple, and the peduncles very short, or even sometimes obsolete, the spikelets being sessile.

The Soft Brome Grass, where abundant, may generally be regarded as indicative either of natural barrenness, or exhaustion of the soil, and its value consists rather in its office of colonizer and renovator than in any addition made to the crop by its scanty foliage. In fields intended for mowing it is an unwelcome intruder, as the hay with which it is much intermingled is always ungrateful to cattle. With a view of extirpating a grass that must on this account be regarded as a mere useless weed, Mr. Sinclair recommends frequent mowing to prevent the seeds arriving at maturity; a valuable piece of advice, as it is very prolific, and not at all prone to abandon ground of which it has once obtained possession.

I believe the five grasses of this section above figured and described, to be forms of the same type, and that type to be *Bromus mollis*, to

which Dr. Withering, and other botanists of the last century, applied the specific name of *polymorphus*, in allusion to the diversity of character presented by it in different localities. Indeed, whether the whole genus, or sub-genus, *Serrafalcus* may not be similarly implicated is, perhaps, an equivocal point; it affords admirable opportunities for the extension of a local flora.

BROMUS ARVENSIS. Taper Field Brome Grass. PLATE CVII.

Panicle loosely spreading, drooping in fruit; the longer lower peduncles compound. Spikelets linear-lanceolate, acute, compressed. Flowers imbricated in fruit, elliptical, smooth. Paleæ shorter than the awn, with two very prominent veins on each side near the margin. Leaves hairy.

Bromus arvensis, *Linnæus. E. B.* 1984; ed. 2. 156. *Parnell. Hooker and Arnott.* Serrafalchus arvensis, *Babington.*

Very locally distributed, and scarcely to be considered as a British grass. It was first noticed by Sherard, who gathered it near Southampton; other habitats recorded are the coast of Durham, near Hebden Bridge, Yorkshire, and Box Hill, Surrey. Dr. Parnell mentions it as being common in France, Germany, and Italy, growing plentifully in corn-fields and by road-sides. The smooth stems vary from a foot and a half to three feet in height. Leaves rather narrow, roughish, especially on the margins, hairy. Inflorescence spreading, drooping when in fruit; the longer peduncles in luxuriant specimens often much branched: the branches and rachis rough. Spikelets linear-lanceolate, six- or seven-flowered, roughish to the touch, but not hairy, frequently tinged reddish-brown. The prominence of the lateral veins of the paleæ is a marked feature, and so is the comparative length of the anthers, which are four times as long as broad, in distinguishing between this and *B commutatus*.

Annual. Flowers in July and August.

There are many points of resemblance between this grass and the foregoing knot of species so called. Mr. Bentham evidently regards the whole series as nearly related, including them all under the present name.

†† Outer palea nine-veined.

BROMUS PATULUS. Spreading Brome Grass.

Panicle spreading loosely, drooping in fruit; the lower longer peduncles compound. Spikelets elongated, linear-lanceolate, acute, compressed. Flowers imbricated in fruit, not hairy. Paleæ shorter than the nearly straight awn, with three prominent veins on each side.

Bromus patulus, *Koch. Parnell*, plate 127. *Hooker and Arnott.* A form of B. arvensis, *Bentham.* Serrafalcus patulus, *Parlatore. Babington.*

Found by Mr. Gibson near Hebden Bridge, Yorkshire, and, if the aspirings of later collectors may be trusted, occasionally occurring among corn as an accidental intruder elsewhere. No figure of this grass is given, because I do not believe in its being other than a very slightly varied form of *Bromus arvensis*, although placed in a separate sub-section. An impartial observer could scarcely arrive at any other conclusion, unless prepared to admit that the development of ten or twelve flowers in a spikelet, instead of only six or eight, is a distinction too important to be slighted; yet on this circumstance the difference of habit between the two seems alone dependent. It is true we have, in addition to this feature of *B. patulus*, comparatively short anthers and nine veins visible in the outer palea, instead of seven only; that is, there is a vein on each side in the one where the space only for a vein exists in the other. If the anthers of *B. arvensis* are not *always* four times as long as broad, and the outer palea of the lowermost flower of one of its spikelets is *occasionally* nine-veined, while those of the others are seven-veined, it is to be feared that the value of such *important* distinguishing characters is somewhat weakened.

Bromus squarrosus. Corn Brome Grass. Plate CVIII.

Panicle drooping, simple. Spikelets few, ovate-oblong or lanceolate, compressed. Flowers nearly smooth, imbricated, compressed. Paleæ about the length of the ultimately divaricated awns; with three prominent veins on each side towards the margin. Leaves hairy or downy.

Bromus squarrosus, *Linnæus*. *E. B.* 1885; ed. 2, 155. *Parnell. Hooker and Arnott.* Serrafalcus squarrosus, *Babington.*

Occasionally met with in corn-fields, and in the southern counties of England, perhaps, not very unfrequently. Like many other plants growing in similar situations, it cannot be regarded indigenous, but as an introduction among seed-corn from southern Europe, in many parts of which it is common in arable and waste land. Stems smooth, a foot to a foot and a half in height. Leaves rather narrow, varying in character of their pubescence from harsh hairiness to soft down. Inflorescence raceme-like and one-sided; the peduncles being almost universally solitary in British specimens. Spikelets more or less erect before flowering, but drooping afterwards; usually very few, oblong-lanceolate, or approaching to ovate, and sub-compressed, ten- or twelve-flowered, nearly smooth. Outer palea more or less distinctly nine-veined, the three veins on each side next the margin usually very prominent. Awn rough, about the length of the palea, straight at first, but afterwards bending outwards, and becoming curved and wavy.

Annual. Flowers in June and July.

At first sight this has much the aspect of being a distinct species, but my opportunities for examination have been few, and I have never had it under cultivation; circumstances unfavourable to forming any decided opinion, especially when associated with the uncertain characters of others, belonging to this ill-assorted genus.

Genus 37. AVENA. Oat Grass.

Gen. Char. Inflorescence paniculate, loose and spreading. Spikelets stalked, laterally compressed, two- or more-flowered, the upper flowers (when more than two are present) often barren or rudimentary. Glumes two, membranaceous, equal to or exceeding the flowers in length. Paleæ two, lanceolate, often hairy at the base, eventually hardening and inclosing the fruit; the lower one two-pointed at the apex, with a long, kneed, and twisted dorsal awn.

The genus may include between thirty and forty species, several of them, however, being doubtfully distinct. Their distribution, chiefly in the northern hemisphere, is almost exclusively confined to its temperate and colder regions, those which are found within the tropics occurring only at considerable elevation. With the exception of the cultivated oats, the annual species are usually considered as useless weeds; the perennial ones are generally liked by cattle, and some are valuable pasture grasses.

The name is Latin, but its derivation cannot be traced.

The genus *Trisetum*, separated from this by Persoon, is not adopted here, as botanists differ in regard to their allotment of the species, but the following sections are worthy of attention by the student.

* Outer glume five- to seven-veined, inner one five- to eleven-veined. Outer palea six- to eight-veined. Spikelets ultimately drooping. Plants annual.

Avena fatua. Wild Oat. Hover. Plate CIX.

Panicle erect. Spikelets drooping, usually three-flowered. Flowers scabrous, hairy at the base, shorter than the glumes. Outer palea bifid at the apex. Awn very long.

Avena fatua, *Linnæus*. *E. B.* 2221; ed. 2. 161. Generally adopted.

A frequent weed in corn-fields, especially among barley, and found occasionally by road-sides and on waste ground, but certainly not indigenous. Stems two or three feet high, smooth. Leaves linear, pointed, rough to the touch. Ligule obtuse. Inflorescence usually a simple panicle, the peduncles being very rarely branched, widely spreading and sometimes more than a foot in length. Spikelets drooping, pendulous when in fruit, usually three-flowered. Glumes nearly equal, smooth, acute, membranaceous; the outer smaller, seven-veined, the inner eleven-veined; both carinate and strongly ribbed. Flowers much shorter than the glumes. Outer palea bifid at the point, eight-veined, with long fulvous hairs at the base; inner palea shorter, with two green, marginal, minutely ciliated veins. Awn very long, (more than twice the length of the flower), knee-bent and twisted.

Annual. Flowers from June to the end of August.

Cattle are fond of the foliage of this grass, but the quantity produced is too trifling to be of any value, independent of its short duration as a summer annual. In corn-fields it is sometimes very troublesome, especially in poor, light soils, where, once introduced, it is very difficult of extirpation, without laying down the land in grass. In such situations it usually towers over the short straw of the barley and wheat, and, if abundant, completely overshadows the crop; not only starving the latter, by abstracting nourishment from the ground, but preventing the ears from ripening. Its habit is the same, wherever met with, from within the Arctic Circle in Lapland to the banks of the Nile, being alike known in all parts as a weed of cultivation, while its wild origin is no more traceable than that of the corn it accompanies. It has been asserted to be the progenitor of the cultivated oat, which is further said to readily degenerate into this assumed wild form; the result of many years of experiment and observation renders me doubtful of such being the case—certainly some five and twenty summers growth of *Avena fatua* in rich soil, and with diversified periods of sowing, have left it as it was from the commencement.

The twisted awns are occasionally employed as hygrometers, on account of their ready extension and contraction under different conditions of the atmosphere as to humidity or dryness. The same property, associated with the bundle of rigid hairs or bristles pointing forwards at the base of the fruit, assists in its dispersion while lying on the ground, as well as in eventually burying it in the soil; every alternate extension and contraction of the awn tending to move it in a backward or downward direction, as the bristles effectually prevent its return. Hence it is often termed the Walking Oat or Animal Oat, a name likewise applied to *A. sterilis*, an exotic species, a native of Barbary, and nearly allied to this, if not, indeed, a southern form of the same.

The resemblance of the flowers, or rather of the awned fruits, to some of the artificial flies used by anglers, is so striking, that they are occasionally employed as substitutes; and that the fish recognise the likeness seems evident, from the fact of more than one fine trout having been trapped by this device in my own presence.

AVENA SATIVA. Common Cultivated Oat. PLATE CX.

Panicle erect, spreading equally. Spikelets drooping, two-flowered. Flowers shorter than the glumes, not hairy at the base. Awn seldom much longer than the flower, sometimes absent.

Avena sativa, *Linnæus*. *Willdenow*. Generally adopted.

The common oat, cultivated over the northern parts of the eastern hemisphere, by both Mongul and Caucasian races, from a period too remote to admit of its history being now traced, is nowhere met with in the wild state; hence, like other species of corn similarly circumstanced, though not indigenous, it has a claim to be noticed as belonging

to every country in which the probable time of its introduction lies beyond the reach of even traditional research; such has been the case with the oat on British soil. The effect of long cultivation under different climates and modes of treatment, and in every kind of soil, has greatly modified the aspect of this and other cereal grasses, and led to the production of numerous varieties, the peculiar or individual features of which are, in some instances, so striking as to have led to the supposition of their being distinct species. Leaving these for after consideration, we will refer to the general characteristics of *Avena sativa* as a separate species. Variable in height, from a foot and a half to more than three feet, the equally spreading or diffuse form of its panicle distinguishes it at a distance from *A. orientalis*, in which the more contracted inflorescence is one-sided; the spikelets of both contain only two fertile flowers, contrasting them equally with *A. nuda* and *A. fatua*, which are both three-flowered. To these characters it may be added that the flowers are never equal to the glumes in length, nor have they ever any long fulvous hairs at the base; while only one of the two in each spikelet is awned, the awn being comparatively short, indeed, in most instances, little more than the length of the palea, to which it belongs, instead of being more than double, as in the common Wild Oat, Hover, or Havers.

Annual. Flowers in June and July.

Though grown by the Romans in Italy, and by other southern people, the oat is strictly considered a cereal, naturally adapted to cold and wet climates, its open spreading inflorescence and few-flowered spikelets being alike favourable to the more ready ripening of the grain, and adverse to the retention of moisture, which in rainy seasons is so prejudicial to wheat and other close-flowering corn plants. Hence the more extensive cultivation of this grain in northern than in southern lands, and its use in the former as a staple human food, while in the latter it is almost exclusively grown for feeding horses. In very warm countries the grain is so small as to be scarcely worth the expense of raising for the latter purpose, and the horses of Achilles at the siege of Troy, as Homer informs us, were regaled with barley.

The English name *Oat* and the Scotch *Ait*, are from the Saxon *Ate*, and evidently associated with the verb *aten* or *etan*, to eat; a circumstance sufficiently indicative of the early use of the grain as bread-corn among the peoples of the north.

The principal varieties of this useful plant, or those which are so strongly marked as to be regarded by certain botanists as distinct species, are *Avena nuda*, the naked oat; *A. chinensis*, the Chinese oat; and *A. orientalis*, the Tartarian oat. Of the last of which we give a figure, though without adopting the opinion that it has any positive claim to being so considered, any more than have its two associates. The strictly agricultural kinds in use among our farmers are much more numerous, but we have no space here for the discussion of their relative values, and the soils to which they are individually best suited, however important such topics may be to the cultivator.

Oats and barley mark the utmost limit of European agriculture,

crops of both being raised by the Swedes and Norwegians as far as 68 deg. N., or within the Arctic Circle; and, of the two, the grain before us has many advantages over its compeer, not only in this high latitude, but in more favoured lands, especially in its facility of growth in almost every kind of soil, from the lightest and poorest of the sandy class to the heaviest and most retentive clays and loams. Under the old system of working the ground until it would yield no more paying crops, and then leaving its restoration to the management of nature, oats were usually the last resort of the farmer before fallowing; and they are still among the most generally profitable of his investments, requiring less manure than either wheat or barley, and being productive upon land that is either too poor or too retentive of moisture to yield well under either of the latter. Oats, indeed, are, under most circumstances, a sure and safe speculation to the grower, though higher-priced grains may often prove conditionally far more remunerative in the market. It must be remembered by the amateur farmer, amidst this laudation, that the oat, like all other kinds of grain, dislikes intruders on its own domain, and that, to derive the full advantage from a crop, cleanly farming is most essential. It will draw for its own support every atom of nourishment contained in the poorest soil, but is liable to be overpowered in this respect by its weed competitors. The oat-growers of Scotland and the Netherlands are well aware of this, and their oat-fields are, in keeping, gardens.

As human food oats are, bulk for bulk, inferior to the other kinds of European grain, containing, on the average, a smaller proportion of the proximate elements of nutrition than even rye: the amount, however, is still large, being about 743 in the 1000 parts. Of these, 641 are starch, 15 saccharine matter, and 87 gluten, albumen, or other nitrogenous compounds. The grain, freed from the husks, is well known under the name of *groats*, and, as well as the flour, or *oat-meal*, is regarded by physicians as one of the most easily digestible articles of diet for the invalid, taken either in the form of gruel or porridge. In Scotland and Ireland, and in the North of England, coarse oat-meal stirred into boiling water, and flavoured with a little salt and treacle, either with or without milk, constitutes a considerable portion of the food of the labouring population, nor is it at all uncommon at the tables of those of higher rank. Perhaps no kind of corn is adapted in a greater variety of ways to the purposes of nutrition. Oatmeal, added to the water in which meat or cabbage of any sort has been boiled, forms a valuable and palatable accompaniment to the daily meal of our northern countrymen, under the denominations of *beef-brose* and *kail-brose;* while, made into dough and baked in thin cakes on a hot-iron plate, it is the favourite bread of those unaccustomed to the flavour of that made from wheat; and, from its former all but universal use as such in Scotland, our sister kingdom acquired its title of the Land of Cakes. In many of the colder districts of continental Europe, the oat is of no less importance than it is in the British Islands. The *haber-meel* of Germany, largely used, both there and in Switzerland, for thickening and rendering nutritive their otherwise thin and poor

broths, and soups, and likewise, as a kind of hasty-pudding or porridge, is coarse oatmeal previously baked to brownness.

The care bestowed upon the cultivation of the oat in those countries in which it may be regarded as a principal staple of human subsistence, has led to the production of some valuable agricultural varieties, among which the Friesland oat holds the foremost rank; the grain of which is much larger than that of those commonly grown in England, and the superiority of the groats imported from Embden, Hamburgh, and other ports of Northern Germany, is due to the excellent quality of the Friesland oat from which they are prepared.

A powder separated from the grain in the process of husking, preparatory to grinding, or the preparation of groats, forms, with water, a kind of jelly much prized, both in Scotland and Ireland, known in the former as *sowens*, and in the latter called *furmety*.

Considered as a bread-corn, the oat in these islands is being rapidly superseded by the more nutritious, and, therefore, more economical wheat. Successive generations have witnessed the steady progress of this change, and the oat-cake, even at the breakfast-table of the substantial Scottish-lowland farmer, is no longer paramount, either having yielded its place to the wheaten loaf, or retaining it only as an occasional luxury, like the muffin and crumpet among the Londoners. For feeding horses, especially where hard work is required from them, no better nourishment has hitherto stood the test of experiment; nor is the cultivation of this grain for such purpose likely to be neglected, unless under some unforeseen revolution in the present system of agriculture throughout Western Europe. Though barley contains a larger quantity of nutriment, it does not appear upon the whole to be so well adapted, in these climates at least, to the digestive powers of the horse; and its higher price in the market, consequent upon the greater expense of cultivation, is another circumstance against its rivalry of the oat. We have no space for notice or discussion of the varied views of writers, practical or theoretical, concerning the manner of administering the grain before us as food, bruised or entire, alone or in combination with other fodder, all of which may have their advantages under different conditions and modes of employment; but a practice that has of late years been apparently gaining ground in France and some other continental countries deserves mention. It is that of making coarsely-ground oats and rye into loaves of baked bread, for feeding horses, a form in which more perfect digestion renders a smaller quantity of food necessary, while the health of the animal is improved by the substitution.

Avena nuda, the naked oat, hill oat, or peel-corn, has its first and last names from the circumstance of the grain when ripe dropping out of the husks, or peeling itself. It is a weed of cultivation in many parts of Central Europe, where it is occasionally grown too as corn, but the grain is much smaller than that of *A. sativa*, even under the most favourable conditions. By terming it "a weed of cultivation," it must not be considered an actually wild or indigenous plant, but as one of fortuitous introduction among those which it accompanies. As such it is sometimes met with, among corn and other crops, on arable land in this country; in the northern and mountainous parts of which it

seems to have been formerly grown in preference to the common oat, whence probably the name of hill oat. The preference in question, referred to the ease of separation from the husk by the simple act of threshing, instead of incurring the labour and expense of carriage to the mill for converting the seed into grist or meal, which in early times, in the wild districts of the North of England, Wales, and Scotland, would be in most cases very considerable. The hill-corn, already free from chaff, was dried on the cottage hearth, had only to be bruised in a rough stone mortar, and was at once ready for family use, as oats and other grain are still prepared in many half-civilized countries. In Scotland the quern-mills are even now occasionally seen, no longer, perhaps, in use, but broken and overgrown with moss, about many of the farm tenements and labourers' cottages.

The naked oat is generally regarded by botanists as a probable, if not, indeed, a positive variety of *Avena sativa*, resulting from degeneration, but its triple-flowered spikelets and some other features render the question a doubtful one. In the latter part of the seventeenth century it appears to have been rather extensively cultivated in England, and according to Ray, the grain sold at about the price of wheat.

AVENA ORIENTALIS. Tartarian Oat. PLATE CXI.

Panicle erect, somewhat compact, one-sided. Spikelets drooping, two-flowered. Flowers shorter than the glumes, not hairy at the base. One flower awned.

Avena orientalis. *Willdenow.*

This is as frequently seen in cultivation as *A. sativa*, and includes, like the last, many agricultural varieties. Whether really a distinct species is very doubtful. The only feature of any importance on which such distinction could be founded, is the unilateral panicle, which certainly gives the present plant a very dissimilar habit to its congener. Some botanists have remarked upon both the flowers being awned, admitting at the same time that the awn is often very short in one. My own experience tends to establish the opinion that the presence of an awn to the second flower is rather an exceptional than a characteristic development: it is certainly so in some of the leading varieties.

Avena Chinensis I have never seen in cultivation. It is stated to have been obtained by the Russians from the north of China, and to be the most productive of all the known kinds of oat. Dried specimens have much the aspect of *A. nuda*, being three-flowered, and the grain, as in the latter plant, loose in the husk, favours the opinion that they are either the same species varied by difference of cultivation, or otherwise, that they are both partially corresponding varieties of *Avena sativa*.

The spikelets of the Chinese oat are sometimes five-flowered.

AVENA STRIGOSA. Bristle-pointed Oat. PLATE CXII.

Panicle unilateral, erect. Spikelets usually two-flowered. Flowers awned, nearly equalling the glumes in length, not hairy at the base. Outer palea terminating in two straight bristles. Awns twice as long as the flowers.

Avena strigosa, *Schreber*. *E. B.* 1266; ed. 2. 162. Generally adopted.

A weed of cultivation only, in this country and elsewhere throughout central Europe, and hitherto unknown in a wild state. It is far from being uncommon in corn-fields, especially among oats and barley, rising generally to the same height, and not very readily distinguishable from the former by the eye in passing. The leaves are rather broad, rough, and often glaucous. Inflorescence erect in the mass, usually a simple panicle, the long, slender, roughish branches of which incline to one side. Spikelets nearly as large as those of the common cultivated oat, seldom more than two-flowered. Glumes smooth, more or less glossy, about equal in length to the flowers. Outer palea terminated by two straight bristles, which, though variable in length, are usually equal to the palea, if not longer. Both flowers are awned, and the great comparative length of the awns, as opposed to those of *Avena sativa*, will serve to direct the attention of a botanical observer, when it grows in a field of the latter.

Annual. Flowers in June and July.

The resemblance between this and the cultivated species is very striking, and has induced many to believe it a mere variety. That it is either such or a hybrid production between that and some other grass, seems indicated by the circumstance of its not having been found truly wild, or elsewhere than in arable land; and, further, by the inconstancy of its re-appearance, year after year, in the same locality. In both these respects it resembles *Avena fatua*, the origin of which is equally problematical.

Its principal distinguishing feature from the other plants of this series consists in the bristles terminating the outer palea.

** Outer glumes one- to three-veined, inner one three-veined. Outer palea five-veined. Spikelets erect. Plants perennial. Ligule acute.

AVENA PRATENSIS. Narrow-leaved Oat Grass. Meadow Oat. PLATE CXIII.

Panicle erect, simple; branches short, scarcely spreading. Spikelets erect, oval, compressed, three- to six-flowered. Flowers scarcely exceeding the glumes, hairy at the base. Leaves more or less involute, their sheaths smooth. Ligule long, acute.

Avena pratensis, *Linnæus*. *E. B.* 1204; ed. 2. 164. *Hooker and Arnott*. *Babington*. Trisetum pratense, *Parnell*.

Rather local in its distribution, and chiefly, though far from exclusively, confined to dry upland heaths and pastures, especially over chalk or limestone. Although occurring occasionally in moist meadows, it is only where the soil contains a considerable portion of calcareous matter. Stems smooth, from eighteen inches to two feet high. Leaves usually involute, unless in moist ground, linear, roughish to the touch; the sheaths smooth. Ligule long, pointed. Inflorescence, mostly a simple and rather compact panicle, with erect rigid branches. Spikelets comparatively large, ovate, or oblong, usually four- or five-flowered. Glumes unequal, acute, often coloured atthe lower part. Paleævery unequal, the awn of the outer one usually about twice the length of the flower.

Perennial. Flowers in June and July.

This grass is found in most parts of Europe, but is of no agricultural value, as its foliage is too short and thin to add much to the general crop; and though cattle and sheep eat it in the early part of the year, it soon becomes too rigid to be palatable to them.

A longer-leaved variety is described and figured by Dr. Parnell in his 'Grasses of Scotland,' plate 52, under the title of *Trisetum pratense, longifolium*, as found in moist shady woods near the sea in the neighbourhood of Edinburgh. The only differences being referable to the effect of moisture and shelter, which favour the growth and expansion of the foliage, as well as the exaggeration of some features of minor importance and consequent alteration of the general aspect; its claim to be considered a permanent form is at present very doubtful. Similar equivocality attaches to the two following, of which, however, we give figures and descriptions as of distinct species. It may be farther questioned, indeed, whether *Avena pubescens*, plate CXVI, is not another form of the protean *A. pratensis*, an admission that would tend far towards rendering the differential features on which our three sections of the genus *Avena* are founded, definitive characters of so many solitary species, instead of marking the limits of a series of groups.

AVENA ALPINA. Alpine Oat Grass. PLATE CXIV.

Panicle erect, more or less simple and compact. Spikelets erect, oblong, compressed, four- or five-flowered. Flowers about the length of the glumes, hairy at the base. Leaves flat; sheaths rough. Ligule acute.

Avena alpina, *Smith*. *E. B.* ed. 2. 165. *Lindley*, synopsis. *Hooker*, Brit. Flora. A. planiculmis, *E. B.* 2141. A. pratensis, var., modern botanists generally.

The English Botany figure was drawn from specimens of this grass, gathered by the late Mr. G. Don, who found it growing about the summits of the Highland mountains of Scotland. It was at first considered to be the *Avena planiculmis* of Schrader, but the error was

afterwards rectified by Sir J. E. Smith, who named it *A. alpina*. It is a much taller and stouter plant than *A. pratensis* in its ordinary form, with longer and broader leaves, and larger spikelets. Stems two or three feet high. Leaves flat, broadly linear, acuminate. Inflorescence more compact than that of the preceding, with shorter and thicker peduncles, which are usually simple. Spikelets erect, variable in the number of their flowers, but seldom having fewer than four perfect ones, which are all awned.

Perennial. Flowers in July.

There is really no structural distinction between this and *Avena pratensis*, but, owing to the more exaggerated development of the present, the habit or general aspect differs so greatly as to render the resemblance between them difficult of recognition by the more general observer, to whom our figure may therefore prove valuable.

AVENA PLANICULMIS. Flat-stemmed Oat Grass. PLATE CXV.

Panicle erect, compound, interruptedly verticillate; branches short. Spikelets much longer than the glumes, clustered, erect, sub-cylindrical, linear-oblong, five- to seven-flowered. Leaves scabrous, broadly linear, suddenly acute, minutely serrated. Sheaths flattened, sharply carinated, scabrous. Lower part of the culm slightly compressed, two-edged.

Avena planiculmis. *Schrader*, Fl. germ. *Hooker*, Brit. Flora, (not of English Botany, see *A. alpina*). *E. B.* Supp., 2684. *E. B.* ed. 2. 165.* *Hooker and Arnott.* Avena latifolia, Host, Gram. Austr. Trisetum pratense, var., latifolium, *Parnell.* A. pratense var., *Babington.*

First published as a British plant in the Supplement to the English Botany, 2684, on the authority of Sir W. J. Hooker; having been then recently discovered by Mr. Stuart Murray, at Glen Sannox, on the ascent of Goat-fell, from Loch Rannock, in the Isle of Arran, Scotland. Our figure and description are both taken from the work above named. It grows in tufts, with stems from one to two feet high in the wild state, but attaining in a garden the height of three feet. The stems are slightly compressed at the lower part, being there covered with the long, roughly pubescent, remarkably compressed, and ancipitate sheaths of the leaves. The lower leaves are almost a foot in length, those of the culm very short; but all of them broad, linear, acute, deep-green, rough on both sides, and especially so on the margins. Ligule oblong, smooth. Panicle with many short, sub-verticillate branches. Spikelets nearly an inch long, broadly linear. Outer palea purplish-green, diaphanous at the extremity, having a twisted awn inserted above the middle of the back. At the base of each flower is a short tuft of hairs.

It appears, that, cultivated in the Glasgow Botanic Garden, from roots brought there by Mr. Murray in 1826, it preserves all its

characters, and agrees in every respect with wild German and other continental specimens. In reference to these characters it is further observed in the 'British Flora,' that "none are so striking as the flat, sharply carinated sheaths, and the great breadth of the leaves, which in cultivated specimens equals half an inch. Their width too is nearly the same throughout, at the extremity coming suddenly to a sharp point." In addition to these features, the apparently verticillate arrangement of the spikelets in successional and rather distant tiers is no less remarkable. Viewed apart, indeed, or in contrast only with the normal form of *Avena pratensis*, no two species could be more distinct; but with *A. alpina*, and its varied gradations intervening, the limit between them is no longer traceable, and the three become as one. Such is the view entertained by many of our best practical men, and careful comparison of the figures and remarks upon them in the present work will tend to its confirmation.

Perennial. Flowers in July.

AVENA PUBESCENS. Downy Oat Grass. PLATE CXVI.

Panicle erect, nearly simple, compact, almost spicate. Spikelets erect, oval, two- or three-flowered, scarcely longer than the glumes. Flowers hairy at the base. Leaves flat, downy. Ligule long, acute.

Avena pubescens, *Linnæus. E. B.* 1640; ed. 2. 163. *Babington. Hooker and Arnott.* Trisetum pubescens, *Lindley. Parnell.*

A native of dry, chalky, and limestone hills and pastures. Stems smooth, one or two feet in height. Leaves flat, rather broad, never involute, flaccid, downy on both sides, and soft to the touch. Inflorescence erect, more or less compact, often so much so as to appear spicate. Panicle generally simple, the branches very short. Spikelets smaller than those of *A. pratensis*, usually only two-flowered, but in luxuriant specimens often four-flowered. Flowers hairy at the base, frequently tinged with reddish-brown, or purple, variegated with the silvery white margins of the paleæ. All the flowers awned.

Perennial. Flowers in June and July.

Independent of its marked pubescent character, this grass has little to distinguish it from the others of its section, and when growing in moist ground it is much less conspicuously downy; while cultivated in a rich soil, it becomes nearly smooth. Where forming a portion of the promiscuous crop, it is eaten down by cattle with the rest, but they dislike hay with which there is much of it mingled; and, like *A. pratensis*, it has no claim to the attention of the agriculturist, being equally deficient in quantity of herbage and foodful quality.

* * * Outer glume one-veined; inner one three-veined. Outer palea five-veined, terminating in two bristles. Spikelets erect. Plants perennial. Ligule short, obtuse.

AVENA FLAVESCENS. Yellow Oat Grass. PLATE CXVII.

Panicle erect, much branched, spreading. Spikelets erect, about three-flowered. Glumes very unequal, the longer about equalling the length of the spikelet. Flowers hairy at the base. Leaves flat, a little downy. Ligule very short, obtuse.

Avena flavescens, *Linnæus. E. B.* 952; ed. 2. 166. *Hooker and Arnott.* Trisetum flavescens, *Beauvois. Babington. Parnell.*

A common grass in dry meadows and pastures, especially where the subsoil is either chalk or limestone. In the loose sandy ground sometimes overlying the former, it occasionally constitutes almost the sole vegetation. Slightly creeping at the root, but not stoloniferous. Stems smooth, glossy, from about a foot to a foot and a half in height. Leaves yellowish-green, flat, acute, roughish on both sides. Inflorescence erect, bright, yellow-green, changing to glossy golden yellow. Panicle much branched, spreading widely while in flower. Spikelets smaller than in any other native species of *Avena*, numerous, erect, short, two- or three-flowered, one flower being often imperfect. Glumes very unequal, smooth, except on the middle vein or keel; the inner larger one nearly the length of the spikelet. Outer palea, bifid at the extremity, terminating in two bristle-like points, the middle vein prominent, the lateral ones indistinct or obsolete. Awns nearly twice as long as the flowers, seldom more than two in each spikelet, the third imperfect flower being usually awnless, and frequently consisting only of a single stalked scale or bristle with hairs at the base.

Perennial. Flowers in July.

This grass may generally be distinguished from all others, at a considerable distance, by the peculiar bright yellow-green hue, of both foliage and panicle, whence the specific name. It is seldom altogether absent from the natural pasture, in either dry or moderately moist soil; and Swayne, Curtis, and other writers belonging to the earlier school of agricultural improvement, toward the conclusion of the past, and the commencement of the present century, praise it highly, regarding it as the most valuable species of its genus for the use of the farmer, the cultivated oat being of course excluded, as a cereal, from their comparison. Among modern writers and experimentalists, opinion concerning its utility is perhaps less decided. Mr. Sinclair recommends its use in laying down land for permanent pasture, but only in admixture with others, and states that he has found it to thrive best when combined with *Hordeum pratense*, *Cynosurus cristatus*, and *Anthoxanthum odoratum*. Dr. Parnell remarks that "sheep prefer it to most grasses," an observation seemingly corroborated by the fact of its generally forming no inconsiderable proportion of the vegetation of the upland pastures on which they thrive the best.

Genus 38. PHRAGMITES. Reed.

Gen. Char. Inflorescence paniculate, loose and spreading, much branched. Spikelets stalked, laterally compressed, two- to six-flowered; the lower flower barren, all enveloped by long silky hairs attached to the rachis of the spikelet. Glumes two, membranaceous, unequal, the lower one shorter than the upper, which is itself shorter than the spikelet. Paleæ two, membranaceous; the outer one much longer than the inner, very much accuminated, awnless.

The genus is a very small one, containing at most only two or three known species, and was originally included in *Arundo*, from which it is especially distinguished by the long silky hairs clothing the rachis of the spikelets, and by the lowermost flower of the latter being always imperfect. *Arundo Phragmites* of Linnæus, the common reed of this country, is the type, and the only well authenticated species. The name is Greek, and denotes the purpose to which it has been applied from a very early period, namely, for forming inclosures, roofing and wattling sheds and other rustic erections, being derivable from *phragma*, a wall or partition.

Phragmites communis. Common Reed. Plate CXVIII.

Panicle slightly drooping, loose, spreading. Spikelets three- to five-flowered, longer than the glumes. Leaves broad, acuminate; the uppermost almost lanceolate.

Phragmites communis, *Trinius. Koch. Babington. Hooker and Arnott.* Arundo Phragmites, *Linnæus. E. B.* 401; ed. 2. 167. *Parnell. Bentham.*

Common throughout the kingdom on the margins of rivers, lakes, and ponds; the latter, when shallow, being rapidly overrun by its growth. It is, however, only found in situations which are covered with water throughout the summer, soon dying away under the influence of drainage. The strong, cord-like stolones creep widely in all directions through the mud; the stems rising erect to the height, in most instances, of five or six feet, though in swampy woods and ditches they occasionally attain ten or twelve feet. In a prostrate or horizontal position, which they are said sometimes, though rarely, to assume, the length of from twenty to forty feet is recorded as the extent of growth, in the 'British Flora;' the circumstances under which this extraordinary development takes place are not mentioned. The leaves, of which there are fifteen or more on each stem, are smooth, often an inch in breadth, and sometimes a foot long; they are gene-

rally so disposed as to project from one side of the culm only, are so strongly veined as to appear almost ribbed, and toward the flowering season are usually split at the summit into numerous capillary segments. Sheaths roughish, strongly striated. Ligule obsolete. Inflorescence an exceedingly compound panicle, varying from a few inches to a foot in length, the branches spreading, and more or less drooping to one side. Spikelets very numerous, purplish-brown, containing three, four, or five flowers, rarely six-flowered, the lowermost flower being always barren or imperfectly stameniferous only. Glumes very unequal, narrow, acuminate, the upper and larger one a little elevated on a short pedicel. Flowers longer than the glumes. Paleæ unequal, membranaceous; the outer much the larger, terminating in a sharp point, but not awned. Rachis of the fertile flowers bearing numerous silky hairs, which gradually lengthen after the expansion of the spikelets, so as to give a beautiful silvery appearance to the panicle as the seed ripens about the commencement of autumn.

Perennial. Flowers in July.

This is one of Nature's most valuable *colonists*, and is largely concerned in the gradual conversion of swamps and fens, stagnant pools, and other unwholesome spots in which water accumulates, into dry land. In some of the low districts of the eastern counties of England, it may be seen entirely overgrowing tracts of considerable extent, called by the inhabitants *reed-ronds*. Such tracts, under the improving hand of modern agriculture, are in a country like ours, yearly disappearing as drainage progresses, and rich pasture or corn-fields replace them; but in lands yet unsubjected to cultivation, or those in which the population is less advanced in the art of farming, the reed itself more slowly fulfils the important change. De Luc, the celebrated geologist of that name in the last century, has well described the process of land formation, as it may be termed, in which the grass before us is the pioneer. In Brandenburg, Brunswick, and other parts of northern Germany, he found at the bottom of every dale, a meadow on a subsoil of peat. Many of these meadows had, within the recollection of old people in the vicinity, a pool of water in the middle of them; while in others such pools or lakes existed at the time of his visit, the ultimate filling up of which seemed to be insured by the causes in action. The sandy sediment carried into the lake by streams, or during rain, gradually raises its bottom near the shore; thus enabling the common reed, already vegetating on its border, to push forward its creeping stolones farther and farther into the shallow water,—it is the leader of the van of progress. Tracing backward from this band of reeds growing in the clear water, another band or border extends, consisting of aquatic plants which vegetate nearer the surface, and rise less above it; on the outer part of this band, *Confervas* (the green thread-like plants that grow in stagnant water) surround the plants in question, like green clouds, almost concealing the fluid in which they grow. These latter form a bed in which *Sphagnum*, Bog-Moss, vegetates and renders the surface more compact. Beyond, still nearer to the firm land, the *Sphagnum* becomes mingled with various marsh flowering plants, and even with some of the meadow grasses that delight in

moisture—thus commences a zone on which cattle may occasionally pasture during the droughts of summer. A little beyond this the ground becomes more and more solid, hay may be made upon it at the proper season; it is the last stage of progress between the swamp and the meadow, and destined soon to become indistinguishable from the latter. Independent of its value in forming land from water, the reed growing along the borders of rivers serves to prevent the wearing away of their banks by the action of the current, and thus guards the low lands on either side against the liability to inundation. The banks of the Thames, and other English rivers, are fortified in this manner, and much of the fine arable and pasture land now found in the valleys along which they flow, has been formed by the gradual contraction of their channels through the growth of this grass barrier.

Perhaps no grass is so widely distributed as *Phragmites communis*, as it is not only met with over the northern hemisphere in both continents, and in our own from Lapland to northern Africa, but is said to be indigenous in South Australia. It is, in an agricultural point of view, useless; as, apart from the necessary conditions of growth, the foliage is too coarse to be palatable to cattle in general, though both horses and cows are said to occasionally browse on it, in the young state, when within their reach, and probably under deficiency of more succulent herbage, while the stolones, like those of *Triticum repens*, *Glyceria fluitans*, and grasses of a similar habit, are sweet and nutritious. Its mechanical applications in the vicinity of its natural habitats are numerous, and especially for the rough purposes noticed above under our description of the genus. The culms form the most durable kind of thatch ever yet employed, and, interlaced in a slight framework of wood or sticks, are used by gardeners as screens for wall fruit-trees and hot-beds, &c. They serve likewise as a good foundation for plaster floors to cottages, barns, and other buildings of the kind. Prior to the introduction of quill pens for writing, which took place about the seventh century in this country, the only pens in use were made of the dried stems of the common reed. Linnæus, in his 'Flora Lapponica,' informs us that the people of East Bothnia regard this plant, so useful to them for the purposes of shelter, as one of the choicest gifts of nature; he states further that the country women in Sweden use the panicles for dyeing their woollen cloths green.

The nests of the sedge and reed warblers *Curruca phragmitis* and *C. arundinacea*, and of the bearded titmouse, *Parus biarmicus*, are generally built between the stems of the *Phragmites*. The first is the most common, and the bird usually selects three stems nearly equidistant from each other, around which the vegetable fibres composing the walls of the nest are firmly interlaced, the base of the nest being securely suspended between them a few inches above the water. The bearded titmouse is a comparatively rare bird in England.

The great length mentioned above, occasionally attained by the prostrate stems of *Phragmites*, applies to stolones projected along the muddy surface of the ground, and not to the culms or flowering stems.

Genus 39. ELYMUS. Lyme Grass.

Gen. Char. Inflorescence more or less compact or spicate. Spikelets sessile, arranged in pairs upon a toothed rachis, each containing from two to four perfect flowers. Glumes two, both on the same side of the spikelet, awnless. Paleæ two, usually coherent with the ripening fruit.

A genus of equivocal extent, distributed over the whole northern hemisphere, especially in the more temperate and colder regions, though two or three alleged species are found within the tropic. In several structural points these grasses are nearly allied to those of the next genus, *Hordeum*, differing from them, almost exclusively, in the spikelets containing two or more perfect flowers, while those of *Hordeum* have only one: indeed, from the circumstance of one of the two flowers in the *Elymus Europæus* of Linnæus being usually barren, most modern English botanists place it in the latter genus.

The derivation of the name is not very evident, but bestowed by the Greeks upon some species of grass, probably one of the Panic-grasses, growing, it has been suggested, about Elyma: it was transferred to this genus by Linnæus.

The true Lyme Grasses are plants of rigid texture, apparently not at all adapted for affording nourishment to cattle, and only useful as colonizers, as exemplified in the British species, *Elymus arenarius*, which, like the sea-reed, *Ammophila arundinacea*, and other sand-binders, is refused by all herbivorous animals.

Elymus arenarius. Upright Sea Lyme Grass. Plate CXIX.

Spicate panicle compact, very erect. Rachis flat, not winged. Glumes lanceolate, downy, about the length of the spikelets.

Elymus arenarius, *Linnæus*. *E. B.* 1672; ed. 2. 171. Generally adopted by modern botanists.

Very frequent on sandy sea-shores, where it sometimes accompanies the sea-reed, (see *Ammophila arundinacea*, p. 14, Plate XII.), or otherwise supplies its place in fixing the loose sand. Stolones widely creeping and rooting, like those of the last-mentioned grass, which, in some situations, they overpower and obliterate. Flowering stems three to five feet high. Leaves very glaucous, rough on the upper side, broader than those of *Ammophila*, but, like them, usually involute and sharply pointed. Ligule very short and obtuse. Inflorescence densely spicate, four to nine inches long, erect, glaucous, spikelets arranged in pairs on each tooth of the rachis, seldom fewer than three- or more than four-flowered. Glumes two, nearly equal, linear-lanceolate, very acute, collateral, or placed together on the outer side of the oppressed spikelet,

instead of being opposite to each other as in grasses generally, downy or hairy, about equal in length to the contained flowers. Outer palea nearly resembling the glumes, but broader, hairy, acute.

Perennial. Flowers in July.

In habit and general aspect this grass is so similar to the one with which it is compared above, that an uninitiated observer would be very likely to confound them, though widely differing in structure. When in flower, this may be readily distinguished by its sessile, three- or four-flowered spikelets, those of the other being stalked and only single-flowered; but, as the flowers of *Elymus* are not of very common occurrence, like those of many other plants that rapidly extend themselves by off-sets from the root, attention should be directed to the ligule, which in *Ammophila arundinacea* is very long and pointed, while in the grass before us it is short and obtuse.

Although too rigid in texture, or otherwise unpalatable, to be eaten by cattle, or, indeed, by the wild herbivorous animals, as hares and rabbits, Sir H. Davy found it to contain a large proportion of saccharine matter, obtaining from its juices and soluble compounds more than one-third of their weight of sugar, a larger quantity than that yielded by any of the more succulent pasture grasses of this country. From this circumstance Mr. Sinclair considers it might rank as the sugar-cane of Britain, and that "cut into chaff and mixed with corn or common hay," it would prove very nutritious. Chemical analysis, however, though it may determine favourably, as in this instance, in regard to the quantity of foodful substance, does not always indicate the fitness of the material examined for the purposes of nourishment; and animal instinct is generally a surer guide, as it is unquestionably here. The quantity of crystalline silicious matter contained in the stems and foliage of all the more rigid grasses, and especially of those that vegetate in sea-sand, must always render them unwholesome, on account of the mechanical injury it is liable to produce upon the lining membranes of the alimentary canal. As a colonist and fixer of loose sand it is unsurpassed by any; but as the importance of its action as such is shared with others of corresponding habit, to avoid repetition, the reader is referred to the remarks concerning the value of its before-mentioned competitor, p. 15.

ELYMUS GENICULATUS. Pendulous Sea Lyme Grass. PLATE CXX.

Spicate panicle bent perpendicularly downwards, lax. Spikelets in pairs, rather distant. Rachis winged, glumes awl-shaped, glabrous, longer than the spikelets.

Elymus geniculatus, *Curtis*. *E. B.* 1586; ed. 2. 172. Generally adopted.

Found by the late Mr. Dickson, one of the most ardent and experienced botanists of his time, in a saltmarsh near Gravesend, Kent. The habit and mode of growth are so exactly correspondent with those

of the preceding, that, excepting the remarkable peculiarity of the fructification, it must be considered the same; but the difference of the latter is so striking as to render the circumstance doubtful. The spike-like panicle is at first erect, but eventually becomes more or less sharply bent downwards at the first, second, or third spikelet, or pair of spikelets, so as to hang perpendicularly. The lowermost spikelet is usually solitary, but those above it are all but universally in pairs, like those of *E. arenarius:* the teeth of the rachis are, however, so widely apart, in its lower portion especially, being sometimes at the distance of two or three inches from each other, as to extend greatly the general mass of inflorescence, which, in garden specimens, occasionally attains more than double the length of that of the erect species, measuring nearly two feet. The edges of the rachis are winged or bordered, but this and the other differential features mentioned in the specific character are of very trifling importance.

Perennial. Flowers in July.

I have seen the original specimen of this curious grass growing in the garden of Mr. Dickson, near Croydon, many years past, and other garden specimens since in the living state and preserved in herbariums; and, while ready to admit that it is one of the most remarkable among grass productions, am satisfied that it has no claim to consideration as a species, though it is a permanent and most singular variety. Sir W. J. Hooker, in the 'British Flora,' refers to his possession of "something very like it in a diseased state of *E. arenarius*, gathered in Scotland by Mr. McNab;" and it is said by Mr. Bentham to be found "occasionally on the coasts of Holland and Scandinavia;" but I am not aware of its having been met with by any person near Gravesend, or elsewhere, in England, since Mr. Dickson's time; and the locality that produced his specimens has long been rendered unavailable to the researches of the botanist.

Genus 40. HORDEUM. BARLEY. Barley Grass.

Gen. Char. Inflorescence compact, spicate. Spikelets subsessile, three together on alternate notches, or teeth of a jointed rachis; the two lateral ones of each cluster usually barren; the central one with one perfect flower, and a second rudimentary only. Glumes two, both on the same side of the spikelet or collateral, ending in long bristles. Outer palea awned, both coherent with the ripening fruit.

A small genus, distributed over the northern hemisphere, chiefly in the temperate regions, of which the kinds cultivated as corn, probably not more than two distinct species, are alone valuable in human economy. The other species, chiefly annual, grow in meadows, pastures, and woods, and occasionally covering poor sandy ground, but are disliked by cattle, and regarded generally as worthless weeds.

The name *Hordeum*, first applied to the cereal species, is of doubtful origin; but, according to some writers, may be derived from *hordus*,

heavy, in allusion to the character of bread made from the corn; such bread was much used among the ancient Romans as food for their soldiery, and others requiring great strength and muscular endurance; hence, indeed, their prize-fighters, or gladiators, were sometimes termed *Hordearii*, or barley-eaters.

The inflorescence of *Hordeum* is rather peculiar, inasmuch as the greater number of the flowers composing it are only rudimentary, and, in many instances, the glumes of the three clustered spikelets are developed in the form of bristles, as so many appendages to the solitary fertile flower.

An exception to the above generic character exists in one division of the cultivated barleys, in which the central flower of each spikelet is almost constantly perfect or fertile; when, as the clusters grow alternately on opposite sides of the rachis, there are six rows of grain along each ear, which has therefore a more or less cylindrical outline, while, if the central spikelet of the clusters is alone fertile, the grains form two opposite rows rendering the ear flat. Our figures of the cereal barleys furnish examples of the two forms, as *Hordeum distichum*, two-rowed barley, and *Hordeum hexastichum*, six-rowed barley. In confining our illustrations to these two, it is not intended to insist upon the fact of only two such species existing; but that such is the belief of the writer, though others recognise six, or even a greater number, among the many varieties of this useful corn under cultivation in different parts of the world. Plants that have, from time immemorial, been under the constant care of man, and which are only known to him as dependents upon his skill and reiterated superintendence, are less amenable to the assumed rules of arrangement than those that, under the government of nature, retain through countless ages the characters first impressed upon them. The constant tendency of human art, even in its rudest efforts, is to change that which it operates upon, and this is the source of all the uncertainty attending the history of almost every cultivated plant. There is even much reason for concluding that our two assumed or admitted species of barley are merely altered forms of the same grass.

HORDEUM DISTICHUM. Common cultivated Barley. Summer Barley. PLATE CXXI. Fig. 1.

Spike linear, flat. Lateral flowers sterile, not awned; fertile flowers forming two opposite rows, awned. Awns nearly parallel with the spike. Paleæ adhering to the fruit.

Hordeum distichum, *Linnæus. Willdenow.* Generally adopted.

The native country of the common barley is unknown, though several travellers have testified to finding it wild in different parts of northern and western Asia, as in Tartary, and, more recently, Colonel Chesney in Mesopotamia, upon the banks of the Euphrates; it should be remembered that in these lands it has been under cultivation from

the most distant periods on record, and is still an annually raised crop. The latter circumstance alone renders the distribution of its seeds by birds, even at considerable distances from the place of growth, so probable as to preclude the necessary assumption of wild propagation in either case. The varieties of this, the favourite barley of English agriculturists, are too many to admit of very close description of it as a species. The height of the straw or culm, the breadth and other characters of the foliage, and the length of the spike or ear, differ greatly in different soils and seasons, leaving little to be added to the above distinctive features. Of these, the flattened form of the spike, occasioned by the constant sterility of the lateral spikelets, will at the first glance separate it from the following, *H. hexastichum* and all its varieties and supposed allied species; but there are two which, holding near relations to itself in this respect, render attention necessary to the succeeding characters of the awns and fruit: these are *H. Zeocriton* of Linnæus, which has a shorter spike, with the awns spreading outwards from it like the sticks of a fan; and *H. gymnodistichum*, distinguished by the ripe grain dropping out of the husk, or in other words, in which the paleæ do not cohere around the fruit. By many persons who have written on the subject, the two plants in question are regarded as true species, and this may be the case with the first, but it is doubtful.

Annual. Flowers in July.

This is the species chiefly cultivated in England, and the varieties of it resulting from difference of soil and treatment are almost innumerable. Some of the latter appear to retain the characters thus acquired through periods of indefinite extent; but the far greater proportion manifest a tendency to change, which renders their relative agricultural value precarious, and frequently leads to disappointment. The fact in question obviates the necessity of noticing them in a work like the present, and it is even doubtful whether in any instance, the permanence of varieties among the cultivated species of grain admits of positive demonstration. The varieties of *Hordeum distichum* are usually sown in this country about the middle of March, the growing barley being very liable to suffer from the alternation of frost and wet weather during the winter, when the seed is deposited before the setting in of the latter season; hence has originated among farmers the distinction into winter and spring barleys; and although the terms merely referred originally to the time of sowing, as certain hardy varieties are better calculated for winter sowing than others, the denominations are not without utility in practice. The spring barley of Norfolk has long held a high estimation in most parts of the kingdom; as, though the ear is usually comparatively short, consisting only of from ten to fifteen grains on each side, the straw is strong and of moderate length, rendering it less liable to be laid or beaten down by rain, than those of taller growth, and with larger and more productive spikes. The name of Norfolk barley is, however, at present one of very indefinite signification. Another variety of *H. distichum*, introduced about thirty years ago, by a gentleman of the name of Chevalier, and called after him Chevalier barley, still holds a high rank among

those now in cultivation here, being, under proper management, more productive than most others; the grain is considerably heavier than that of the common sort, in the proportion of 57 lbs. to 52 lbs. per bushel, and at the same time the ears are usually much longer, (in a specimen now before me, there are twenty perfect seeds on one side of the spike, and twenty-two on the opposite). These advantages are, however, counter-balanced by the general thinness of the straw, and its harsh and rigid texture, the first rendering it liable to be borne down by the weight of the ear during high winds or heavy rain, while the second interferes with its adaptation as food for cattle.

The use of barley was formerly far more general among European nations than it is at present, and will probably farther decline as the improvement of agriculture extends, in those countries at least which admit of the cultivation of wheat. In Britain its most important use has been for a long period in the manufacture of *malt*, a purpose for which it is better fitted than any other kind of European grain, on account of the large proportion of sugar contained in the seed. In foodful quality barley is far superior to oats; the better kinds of this grain yielding according to chemists 920 parts in the 1000 of nutritive matter, 70 of which are sugar. It would not appear, however, that the presence of this quantity of sugar is the only recommendation of barley for the use of the maltster, though the value of his manufacture to the brewer and distiller is mainly dependent upon the proportion of that product. In addition to its sugar, the average quantity of starch in this grain is nearly equivalent to that of wheat; and in the process of malting a considerable portion of the latter becomes converted into the former.

Barley is more used in this country in the form of pot and pearl-barleys than in the state of meal or flour, the labouring classes of the North of England and Scotland generally evincing a preference for the oat as bread. Pot-barley or Scotch-barley, used in broths and soups, is the grain simply freed from the husk, in mills constructed for the purpose; in pearl-barley the grinding process is carried a little farther, so as to remove the extremities of the seed, and render it nearly round. The object in pearling barley is the removal, not only of the skin but of the embryo or young plant at the base of the seed, in both of which there is a peculiar flavour, dependent on the presence of an essential oil, disagreeable to most persons accustomed to the use of other grain. The prepared or patent-barley, employed for making barley-water and other beverages for the sick, consists of this pearl-barley ground to powder in a common mill; it is a more useful form for this purpose as being more quickly converted into the necessary drink. A decoction of the entire grain is somewhat acrid and bitter in taste, and liable to disagree with the stomach.

The English name of this corn seems to have been derived from the Celtic *bara*, bread, and that of the barley itself in the same language, *bere*, pronounced broadly *bare*, among some existing peoples of that race, indicates the early cultivation of it in Europe. Our word *beer* is only a slight alteration from the latter, as being the source of the beverage so denominated.

Hordeum Zeocriton, so called from the Greek *zea*, a kind of wheat supposed to be that now known as *spelt*, and *krite*, barley, was formerly much cultivated in England, but is seldom seen at the present. The comparative shortness of the ear seems to indicate the probability of its being less productive than the more favoured varieties of the common barley; but it is more hardy, and better adapted to stiff clayey soils than the preceding. The name of Putney barley is sometimes given to it by our seedsmen, in consequence of public attention having been first attracted to it by some grower in the vicinity of the village so called; but it is better known by that of Battledore or sprat (spread) barley, in allusion to the form of the spike with its widely spreading awns. In some parts of Germany it is largely cultivated, the grain being greatly esteemed as a substitute for rice, hence it is occasionally met with in England as an imported article under the name of rice barley, or German rice, being used like the pot barley, as an ingredient for puddings, broths, &c. Whether really a distinct species, or only a permanent variety, is as before remarked, p. 144, equivocal.

Hordeum gymnodistichum bears a corresponding relation to the common spring or summer barley, to that which *Avena nuda*, the hill-oat, does to *A. sativa*, and its claim to rank as a species is equally problematical. It is not an object of cultivation in these islands.

HORDEUM HEXASTICHUM. Winter Barley. Bere. Bigg. PLATE CXXI. Fig. 2.

Spike sub-cylindrical. Spikelets all fertile; fertile flowers in six rows, all awned. Awns somewhat spreading. Paleæ coherent to the fruit.

Hordeum hexastichum, *Linnæus. Wildenow.* Generally adopted.

The history of this species, if such it really be, is quite as obscure as that of our other kinds of grain. It is pre-eminently the barley of cold climates, as *H. distichum* may be said to be that of temperate and warmer, and is the one the cultivation of which accompanies that of the oat in Swedish and Norwegian Lapland, even within the polar circle. Ripening much more readily than the preceding, and being hardier, so as to stand through the winter, unless under very unfavourable circumstances, it is more commonly grown on the Continent than with us; but the grain is lighter and otherwise inferior to that of our ordinary spring-sown barley. Cultivation in different climates has led to the production of many varieties, some of which have been more highly praised, perhaps, than after experience has justified when tested by our English agriculturists. Its chief value seems to consist in its adaptation to more exposed situations and poorer soils than those required by the spring or summer barley; the latter indeed is a grain suited to a higher system of cultivation than is yet extant in most of

the continental lands of Europe, where its comparatively greater productive character is not understood. Hence the exaggerated accounts given by French and German agricultural writers concerning certain kinds of the species before us, one of which, supposed to have been introduced into Western Europe from Russia, was named by the former *orge céleste*, on account of its vast superiority over the old winter-sown barley previously in use among French farmers. This, an evidently near ally to the old Siberian, is by some botanists regarded as a probably distinct species, though only separable from the ordinary winter barley, by the grain being loose in the husk, whence they style it *Hordeum gymno-hexastichum*.

The rows of grain in this species are sometimes, owing to partial abortion, only four, hence Linnæus and Wildenow were led into an error and have recorded another species so distinguished, under the title of *H. vulgare*.

Annual. Flowers in July, or earlier, according to the season or time of sowing.

Certain varieties of this grain are known by the name of black barleys, in consequence of the dark hue of the husk; the same is the case with the varieties of the oat, and such are regarded generally as more hardy than the paler kinds, though without any apparent foundation for the belief.

HORDEUM PRATENSE. Meadow Barley Grass. PLATE CXXII.

Glumes all setaceous, rough, (never ciliated). Lateral spikelets imperfect. Outer palea of the fertile middle flower with an awn equal to it in length.

Hordeum pratense, *Hudson. E. B.* 409: ed. 2. 175. Generally adopted by British botanists. H. murinum, *β. Linnæus.* H. nodosum, *Koch.*

Not an uncommon grass in moist meadows and pastures, in most parts of England, except in the extreme western counties of Cornwall and Devonshire. In Scotland and Ireland it occurs but rarely, as though its introduction had been accidental. In situations favourable to its growth, it is among the taller grasses of the meadow, the flowering-stems attaining the height of eighteen inches to two feet, or more. Leaves narrow, linear, flat, hairy on both sides, roughish to the touch; ligule very short. Spike dense, compact, an inch and a half to two inches long, nearly cylindrical. Fertile flower of the central spikelets with an awn about equal to it in length; lateral spikelets barren, their flowers being either abortive or stameniferous only; glumes of all three bristle-shaped, rough. Lateral barren spikelets pedunculate, central fertile one sessile.

Perennial. Flowers in June and July.

The meadow barley grass is in rich moist soil, highly productive yielding an early crop of very nutritive foliage, apparently well-relished

by cattle and sheep; indeed, it was observed by Mr. Sinclair to constitute the principal herbage of certain pastures in Norfolk that were regarded as excellent for feeding the latter. As an agricultural grass, however, it cannot be recommended, as the numerous stiff and sharp awns of the inflorescence render it deleterious to the animals that consume it in the form of hay, so much so that they often instinctively refuse that of which barley grass forms any considerable proportion.

Hordeum pratense seems almost exclusively confined to temperate climates, being distributed all over central Europe, and the milder regions of Russian Asia; but not extending into the northern parts of even Norway and Sweden, nor southward to the basin of the Mediterranean.

When growing on lands that suffer from drought during the summer, but are liable either to occasional overflowing, or to have water lying on them through the winter, nodes or bulbs often form about the root or base, hence it is mentioned by some continental botanists under the name of *H. nodosum*.

HORDEUM MURINUM. Wall Barley Grass. Way Bennet. Mouse Barley. PLATE CXXIII.

Glumes of the middle spikelet linear-lanceolate, ciliated; those of the lateral ones, setaceous, rough. Lateral spikelets imperfect. Awn of the fertile middle flower much longer than its palea.

Hordeum murinum, *Linnæus*. *E. B.* 1971; ed. 2. 174. Generally adopted.

One of the most common of British grasses, throughout England especially, where it grows on every road-side and field-path, along the bases of walls and fences, on heaps of rubbish and dry waste ground, which latter it sometimes covers to the exclusion of all other vegetation. In the meadow and pasture it seldom intrudes, preferring hard and dry ground unoccupied by other plants, and indeed appearing to flourish most where it is liable to be frequently trodden down. Stems tufted, decumbent at the base, a foot or more in height when not stinted by being trodden, but more frequently five or six inches only. Leaves more or less rough and hairy, linear, acute; their sheaths inflated. Spike dense, about two inches long, not including the length of the awns. Fertile flower of the central spikelets terminating with an awn considerably longer than itself; lateral spikelets barren, their flowers being usually imperfectly stameniferous. Glumes of the fertile flower narrow-lanceolate, ciliated, terminating in a long, straight, rough awn; those of the lateral, stalked, barren ones bristle-shaped, rough.

Annual. Flowers in May and to the end of autumn.

A weed, but one that seems to know its place, and never troubles the cultivator. Like most other colonizing grasses, it is almost devoid of nutritive properties, and grazing animals rarely crop even the early spring foliage.

Mr. Babington mentions a variety growing on the sands of the sea-shore, *Hordeum murinum β. arenarium*, having "the lower part of the stems buried, lengthened, and rooting, thus appearing to creep." The wall barley grass not unfrequently grows in such localities, but I have not observed any very striking alteration of habit thus induced. A specimen, however, was brought to me last summer, either from Cromer or Scarborough, according with Mr. Babington's description above, or possibly exceeding his plant in its tendency to the creeping habit; as it had the aspect of a perennial, it is worthy of farther inquiry by those who may have the opportunity of so doing.

HORDEUM MARITIMUM. Sea-side Barley. Squirrel-tail Grass. PLATE CXXIV.

Inner glume of the lateral spikelets dilated, semi-ovate, terminating in a long rough awn; the other glumes all setaceous, rough, (none of them ciliated). Lateral spikelets imperfect.

Hordeum maritimum, *Withering*. *E. B.* 1205; ed. 2. 124. Generally adopted.

Common in sandy pastures near the sea, round the English coast, and that of Ireland, but scarcely extending to Scotland. It is the smallest species of its genus, its stems rarely reaching the height of a span; they are smooth, glaucous, and procumbent at the base. Spike one or two inches in length, somewhat four-sided, very compact. Fertile flower of the central spikelets with an awn rather longer than itself; its glumes setaceous or bristle-like, very brittle, and rough, as are likewise the outer ones of the lateral barren spikelets, never ciliated. Inner glumes of the latter dilated on one side below, so as to be of a half oval form, and terminating in a long sub-unilateral awn. Lateral spikelets pedunculated, central one sessile.

Annual. Flowers in June and July.

A useless grass, agriculturally considered, being equally destitute as *H. murinum* of nutritive qualities; while, unlike the latter, it is a most troublesome and dangerous weed in maritime, meadow, and pasture land, as, when mixed with hay, its brittle and strongly-barbed awns pierce and irritate the gums of horses so as to induce severe inflammation; and in the days of equestrian travelling, one of the greatest recommendations of an inn in the Isle of Thanet, where this grass is very common, was that of having hay without any mixture of squirrel-tail.

This species does not seem to have attracted the attention of the older botanists, having been probably confounded by them with the wall barley grass. It appears to have a very local distribution, being confined to the shores of the Mediterranean basin and the western coast of Europe, along which latter it has not extended itself beyond Jutland, and Forfarshire in Scotland.

HORDEUM SYLVATICUM. Wood Barley Grass. Wood Lyme Grass, PLATE CXXV.

Glumes all subulate, rough, (not ciliated). Lateral spikelets fertile; central one (usually) imperfect. Outer palea with an awn twice its own length.

Hordeum sylvaticum, *Hudson*. Most modern botanists. Elymus europœus, *Linnœus*. *E. B.* 1317; ed. 2. 173.

A native of woods and thickets in many parts of England, though chiefly, perhaps, over a subsoil of chalk or limestone. Stems erect, about two feet high. Leaves comparatively broad, linear-lanceolate, attenuated, pointed, rough, especially on the edges. Ligule short, blunt. Inflorescence compact, or more or less interruptedly spicate, about three inches long, linear. Spikelets one- or two-flowered; the two outer ones bearing one fertile flower, and occasionally the rudiment of a second; the middle one frequently barren, when its glumes are short and involute at the edges so as to appear setaceous. Glumes of the fertile spikelets of equal length, dilated, three-veined, terminating in an awn, rough, but not ciliated. Spikelets sessile, or nearly so.

Perennial. Flowers in July and August.

It is not a grass of any value to the farmer, being deficient in nutritive quality, and disliked by cattle. Like other species belonging naturally to shady situations, it dwindles under exposure.

Genus 41. SECALE. Rye.

GEN. CHAR. Inflorescence compact, spicate. Spikelets solitary in the notches, or teeth of the rachis, two- or three-flowered; the two lower flowers fertile, sessile, opposite; the upper one barren or rudimentary only. Glumes subulate, opposite, shorter than the flowers. Outer palea entire, awned; inner one bifid.

This genus, founded on the common cultivated Rye, *Secale cereale*, and strictly considered, perhaps, consisting of that original species only, is said to have derived its name from the Latin *seco*, to cut. The Rye is mentioned under this name by Pliny, but does not appear to have been an object of cultivation by the Romans, though probably the chief bread-corn in use among the Gauls at the time of their conquest by the former: the Celtic name for a sickle, *sega*, a word from the same root, affords an equally plausible origin for the title of the earliest kind of grain grown by the people of that race.

While the genera *Avena*, *Hordeum*, and *Triticum* include, besides the cultivated Oats, Barleys, and Wheats, several of our indigenous grasses, *Secale* has no further claim to a place in our catalogue than as representing a cereal associated with the practice of agriculture in these islands from the most distant period of their history.

SECALE CEREALE. Common Rye. PLATE CXXVI.

Stem erect. Glumes and awn rough. Paleæ smooth.

Secale cereale, *Willdenow*. Generally adopted.

Only known in the cultivated state, though said by some travellers to have been found wild in the north-western parts of Asia, in the Crimea, and the Island of Candia, in all of which it was probably cultivated from time immemorial. Varies in height according to soil and situation, but seldom attains more than three feet. The culm or straw differs from that of most other grasses in being solid, or filled with pith, instead of fistula or hollow between the joints. Spike compact, four or five inches long. Spikelets with two perfect flowers, which are sessile and distichous, with the rudiment of a third terminal one. Glumes two, nearly opposite, keeled. Lower palea unequal-sided, terminating in a longer or shorter rough awn; upper one shorter, usually bifid at the summit. Caryopsis hairy at the point.

Annual. Flowers in June and July.

Cultivated extensively throughout England in former times, Rye is at present seldom grown by our farmers for the sake of the grain, though, next to wheat, unquestionably the most nutritious of the European bread-corns. Inferior to barley in the quantity of starch and sugar contained in the seed, it is far richer in nitrogenous matter, the proportion of gluten and albumen being nearly double that found in the latter grain, or 109 parts in the 1000 instead of 60; that in wheat varying from 200 to 250, a circumstance that renders it superior to every other cereal as human food, and which has necessarily led to that increased cultivation that has nearly banished rye from our soil, unless sown as a green crop for cattle and sheep, the seed required for such purpose being mostly imported. In many parts of the continent rye is grown in large quantities as food for the labouring classes especially, and is sometimes sown mixed with wheat; a custom that once prevailed in this country, previous to the introduction of those improvements in the system of agriculture which have elevated it from an imperfectly practised art to the rank of a science. The two kinds of grain, reaped and ground together, formed a bread known by the name of *meslin*, from an obsolete French or Norman French word, *meslè*, mixed. This bread is highly extolled for its wholesome quality by some old writers on medicine; and, indeed, the brown bread of the London bakers, more than half a century back from the present time, made of a mixture of wheat and rye flours, was an imitation of it. The sowing of the two kinds of corn in the manner above-mentioned, seems to have originated in an unfounded supposition that if one of them failed the other might yield a crop, and thus ensure some return to the farmer in place of disappointing his hopes altogether: rye, however, generally ripens much earlier than wheat, there being at least ten days or a fortnight difference between them in that respect when sown at the same period, a fact that must have been attended occasionally with considerable loss

on the part of the former, by the shedding of its grain from over-ripeness before that of the latter was sufficiently matured.

In countries where rye is extensively cultivated the grain is often made into malt, and is said to be more valuable for brewing beer than barley malt; more economical it certainly must be, if, as we are informed, a bushel of rye malt is equivalent to at least a bushel and a quarter of that made from barley. The spirit imported under the name of *hollands* is chiefly distilled from rye.

Perhaps the greatest recommendation of this valuable cereal to the cultivator consists in its being hardier than wheat, and capable of growing in wet, cold, and even poor soils, from which it would be impossible to obtain a remunerative crop of the latter—or indeed of any other grain: added to this, it occupies the ground a shorter time, no small inducement to those carrying on a confined system of husbandry, especially as small proprietors with very limited appliances, so many of which are found among our continental neighbours. Large farms, and the increased capital now employed to work them, associated with the generally higher standard of food consumption that prevails through our own population, as compared with that of France and other countries, are the chief sources of that change under which rye has been, for many years past, nearly excluded as a bread-corn from the English market.

Though as plants of annual duration only, the value of the cereal grasses is almost universally estimated by the quality of their grain, their herbage is, collectively considered, among the most nutritious of green vegetable productions, and superior to that of most other members of the group before us. Allusion has already been made above to the use of rye as a green crop; and the practice of sowing it for that purpose only, which has been extending in England during the last twenty or thirty years, may be regarded now as one established on the basis of experience and remunerative result. Agricultural writers inform us that, sown in the autumn it may be fed off by sheep early in the spring, leaving the ground in a highly improved condition for raising a crop of potatoes or turnips within the year; or if sown in the latter part of the summer, immediately after the wheat harvest is carried off the ground, or very early in the autumn, the sheep may be turned in upon it in October or November, when other food for them is becoming scarce, without at all injuring the succeeding spring produce.

The varieties of *Secale cereale* are apparently numerous, but less striking in character than some of those belonging to the wheat, barley, and oat. One of them is by some botanists regarded as possibly a separate species, the *Secale orientale*, hairy spiked rye of our catalogues; but the distinctions between it and the common rye are probably only dependent upon its cultivation in a warmer climate. It differs somewhat in habit, and is described as being biennial. It is probably the kind known in France as *Seigle de Saint Jean*, St. John's day rye, which is stated to grow "so rapidly, that if sown about St. John's day (Midsummer's-day), it will be fit to mow green by the middle of September, and in favourable seasons may be fed off again in November,

without preventing its giving ample feed in Spring, and a good crop of grain at the next harvest." How far these qualities might be realized in our variable climate is doubtful.

That all plants are, like animals, liable to diseases of varied character and origin, is a well-known circumstance; and those of the great family of the grasses, more especially of the cereals, are peculiar and striking. The recognition of them in the latter, premonitory as they are of disappointed hopes to the farmer, is of high antiquity; and, in certain instances, may date from the earliest periods of cultivation, without having manifested any change in symptoms or destructive influence. Such is probably the case with one to which rye is subject, namely, that denominated *ergot*, from the French name for a cock's spur, which the diseased and altered grain somewhat resembles in form. The disease in question, though popularly known and described in its association with rye only, is not at all uncommon among other grasses, especially such as grow in marshy meadows, and places liable to occasional inundation; while in very wet seasons many of the ordinary pasture species are affected by it to a considerable extent, as I noted to be the case last summer, 1860, with *Alopecurus pratensis*, *Phleum pratense*, and *Dactylis glomerata*. The rye so affected, commonly called *spurred rye*, or by naturalists *Secale cornutum*, has occasionally, in districts where this grain constitutes the principal bread-food of the lower classes, been productive of most alarming and even fatal consequences to the consumers. A diseased specimen is figured on our plate 126, in contrast with a healthy ear or spike, as are likewise views of the enlarged and distorted grain and of the granules, *sporidia*, by means of which the disease, or at least the fungoid growth by which it is accompanied, is propagated.

No positive evidence of the effect of *ergot*, as observed by the late Dr. Pereira, is found among the writings of the ancients; but, admitting this fact, it is still difficult to believe that a disease of so common occurrence in cultivated grain, may not have been the cause of certain, otherwise unaccountable, local epidemics referred to in history. A quotation, by the author just mentioned, from an early French writer, seems a case in point, as the circumstances detailed are perfectly consistent with the known effects of *ergot*. "1089. A pestilent year, especially in the western parts of Lorrain, where many persons became putrid, in consequence of their inward parts being consumed by St. Anthony's fire. Their limbs were rotten, and became black like coal. They either perished miserably; or, deprived of their putrid hands and feet, were reserved for a more miserable life. Moreover, many cripples were afflicted with contraction of the sinews." No notion seems to have been entertained respecting the origin of the above dreadful disorder from the use of diseased corn as food, although it is further on record that "the bread which was eaten at this period was remarkable for its deep violet colour." Nor indeed was it until toward the termination of the seventeenth century that the attention of the medical and scientific world was first particularly directed to the subject by M. Dodard. From the year 1676, in which his observations

its appearance on different parts of the Continent, as in France, Switzerland, Prussia, Saxony, Bohemia, Denmark, and Sweden, the symptoms and results being in all instances more or less corresponding. The district of Sologne, in France, situated between the rivers Loire and Cher, where the subsoil is a cold, retentive clay, seems to have been the most frequent scene of its disastrous recurrence. The soil there is described as being so poor, that, although it is allowed to lie fallow every third season, it becomes completely exhausted at the end of ten or twelve years at farthest, so that the farmers are compelled to let it remain a long while in the state of pasture, before it will again bear corn; while it is at the same time so wet, that, to avoid the rotting of the seed-corn, they are obliged to sow it on the tops of furrows a foot high. These are the conditions most favourable to the production of *ergot*, which seldom attacks the grain, unless in excessively wet seasons, in countries where an advanced system of agriculture is in practice, and the land consequently well-drained.

As occurs in regard to the origin of those destructive blights which have effected the potato and grape in our own times, considerable diversity of opinion exists respecting the source of that now before us; some attributing the formation of *ergot* to the growth of a parasitic fungus, and others to a mere alteration of the grain itself by disease. Both of these hypotheses are probably equally entitled to our consideration; a fungoid production is unquestionably present, while the grains of *ergot* are in their early stages of development, crowned with the feathered stigmas, evincing that they are at that time the immature ovaries of the rye flowers. Admitting, nay, being capable of demonstrating both these facts, we are justified in assuming that the general circumstances requisite for fungus growth involving the presence of diseased or decomposing organic matter, imply that the development of the *Sphacelia segetum*, or *Spermoëdia clavus*, as the *ergot* fungus is styled by botanists, is a result of previous disturbance in the healthy functions of the ovary in which it takes place, and not the primary cause of the disorder.

In all records concerning the deleterious action of *ergot*, the grain so affected seems to have been eaten in considerable quantity, or as daily food, for weeks and even months successively. The consequences, though differing in different constitutions, are chiefly correspondent with those noticed in our preceding paragraph, as characterizing the pestilence in the year 1089; a disorder now known among medical writers and practitioners as *gangrena ustilaginea*, or *dry gangrene*. It commences with pain in the extremities of the limbs, which soon become insensible and cold to the touch, eventually shrivelling and drying up as they assume a black appearance; the decay gradually extends towards the body, the parts affected separating and dropping off in succession. These fearful results, due to the poisonous quality of the fungus, are doubtless enhanced by deficiency of nutriment in the rest of the grain, not properly matured in the wet seasons favourable to the production of *ergot*. Similar effects to the above have been produced upon pigs, fowls, and many others of the lower animals, fed on spurred corn by different experimentalists; the first symptoms induced being giddiness or appa-

rent palsy, followed by tumours on various parts of the body, gangrene, and ultimate dropping off of the toes. According to the observations of M. Tessier and others who have bestowed much pains in investigating this subject, it appears that the natural instinct of most animals leads them to refuse diseased grain, either alone, or mingled in any appreciable quantity with their accustomed food, rendering its administration for the purpose of experiment very difficult. An exception to this aversion, and likewise to the deleterious action of *ergot*, has been noted in oxen, sheep, and other ruminants, animals which, owing to the peculiar structure of their stomachs, are less susceptible of injury from vegetable poisons than those belonging to other orders of mammalia. In Pereira's Elements of Materia Medica it is stated, on reliable authority, that in a series of experiments on the Continent, "in 1811, twenty sheep ate together nine pounds of it (spurred rye) daily for four weeks without any ill effects. In another instance, twenty sheep consumed thirteen pounds and a half daily for two months, without injury. Thirty cows took together twenty-seven pounds daily, for three months, with impunity; and two fat cows, took in addition, nine pounds of *ergot* daily, with no other obvious effect than that their milk gave a bad caseous cream, which did not yield good butter." To the above remarks it may be added, that when administered for medicinal purposes, the action of *ergot*, even when given apart in very large quantities, often fails altogether in the case of ruminant animals. Such exceptions, therefore, lend no support to the arguments of those who entertain sceptical views respecting the deleterious nature of diseased or blighted grain, the use of which as food cannot be too forcibly deprecated, or too sedulously avoided, a fact that will be farther demonstrated in our notice of the cultivated wheat.

Rye being little used in this country as grain, *ergotism* is not a recognized form of disease here as it is on the Continent; but the late Dr. Willan was of opinion that many pestilential epidemics of past periods were due to this cause, and among them the *sweating sickness* in the beginning of the sixteenth century. At this time it was remarked, as recorded by Schiller, in his treatise, 'De Peste Britannica,' that birds fell dead off the trees, with small abscesses under their wings; a fact mentioned by him as instancing the poisonous quality of the air at the time, but which, as the Doctor observed, was more probably occasioned by the damaged grain taken as food.

The medicinal use of *ergot* is far from being inconsiderable, and it is imported hither from France, Germany, and America. The retail price varies, according to supply and demand, from ten to twenty shillings per ounce; hence it has been remarked that if a pound were collected from a field of rye, it would be worth more than the produce in sound grain from an acre of the best land. The conspicuous character of the spurred grain, arising from its length standing out beyond the ear, and blueish-black hue, would render such collection very easy.

Genus 42. TRITICUM. Wheat, and Wheat Grass.

GEN. CHAR. Inflorescence compact, spicate. Spikelets solitary, sessile on opposite sides of the channeled, more or less distinctly jointed and toothed rachis, two- or three- to many-flowered; compressed or somewhat turgid, their sides directed towards the rachis. Glumes two, opposite, carinate, acute or mucronate, nearly equal. Palæ two; the outer one acuminate, or awned; the inner bifid at the apex.

The species, about twenty-five in number, are widely distributed over the northern and central countries of the eastern continent, but are not found in the opposite hemisphere, unless where introduced by European cultivation. The genus includes the cultivated wheats, of which there are numerous varieties, and perhaps some very distinct species, valued almost exclusively on account of their grain, which affords the most nutritive of all vegetable food; all of these are annuals: others, usually denominated wheat grasses, are mostly perennial, useful in the general economy of nature, some as colonizers, others as contributing to the support of herbivorous animals collectively, but by the farmer regarded as mere weeds, being ill adapted to agricultural purposes.

The generic name, that of the common wheat, among Latin writers, bears allusion to the process of threshing or beating by which the grain is separated from the ears or spikes, or to that of grinding to reduce it to the state of flour.

The genus is divided by some modern botanists into two sections, *Triticum*, the true cereal wheats, and *Agropyron*, the wheat-grasses, some of the latter only are strictly indigenous, not to these islands alone, but to Europe collectively.

Triticum. *Linnæus.*

Annual. Spikelets more or less ventricose and turgid. Glumes and paleæ ovate or oblong.

TRITICUM SATIVUM. Common cultivated Wheat. PLATE CXXVII. and CXXVIII.

Spike imbricated, four-cornered. Spikelets usually four-flowered. Glumes ventricose, ovate, truncate, mucronate, compressed below the apex, convex on the back with a prominent midvein.

Triticum vulgare of some authors. Triticum æstivum, hybernum, &c., *Wildenow.*

The varieties of wheat met with in cultivation are more numerous than those of any other kind of grain, and are supposed by some botanical and agricultural authors to include at least two distinct species, if not, indeed, a greater number. The distinctive features of these are, however, far too indefinite to admit of our arriving at any satisfactory conclusion respecting them from comparison; hence only three marked forms are presented among our figures, namely, *Triticum æstivum*, Summer or Bearded Wheat, *T. hybernum*, Winter, Lammas, or Beardless Wheat, and *T. compositum*, Branch-eared or Egyptian Wheat. The English names of the first two, and especially in reference to the bearded or beardless character, are very arbitrarily bestowed, as some of the varieties of *T. hybernum* have comparatively long awns. It is to the latter that the kinds of this most useful of all European grains grown in the British islands nearly exclusively belong, the varieties of *T. æstivum* being better adapted to more southern and drier climates. Those of both species, however, if species they originally were, have been so crossed and multiplied that their natural affinities to either, individually, are no longer traceable with any degree of certainty; and so diversified are the characters they present under difference of climate, soil, and culture, as to render particular description unavailable.

The origin of wheat is involved in equal obscurity with that of other kinds of grain, and indeed of most plants the cultivation of which has been carried on from very remote periods. Though alleged to be found wild in various parts of Central and Western Asia, its association with the permanent vegetation of those districts, otherwise than as an accidental intruder, has never yet been determined. The supposed derivation of our staple corn, by successive culture, from certain species of western Asiatic and southern European grasses, belonging to the genus *Ægilops*, as noticed in page 8 of the introduction to the present volume, however plausible it may appear from the experiments of M. Fabre and the advocates of his hypothesis, is far from being any approach to the elucidation of the subject; his wheat, so called, being not true wheat, but a hybrid production of corresponding class to many of those which the advancing ingenuity of modern horticulturists is all but daily bringing into existence. As our acquaintance with the metamorphic capabilities of plants is very limited, there is still, however, a possibility that farther observation and experiment may establish as fact that which is, under present circumstances, problematical.

The superiority of wheat, as a bread-corn, over every other kind of cultivated grain, is indicated both by the result of chemical analysis and the larger comparative quantity of flour which it yields. Thus 1,000 parts of barley contain 920 of nutritive substance; of rye, 792; of oats, 743; and of the different kinds of wheat from 940 to 960; while fourteen pounds of wheat yield thirteen pounds of flour, fourteen pounds of barley only twelve pounds, and an equal quantity of oats no more than eight pounds. Added to these considerations in favour of wheat as an economical production, may be noted the higher rank which its flour holds among the supporters of animal life. This is due to the large quantity of *gluten* it contains, amounting to more than

one-fifth of its composition, or varying in the 1,000 parts from 190 to 240. Separated by washing from the starch with which it is combined in wheaten flour, this *gluten* is well known as an article of human food in the forms of Macaroni, Vermacelli, &c., and may be classed among the most nutritive of all vegetatable products; containing, as it does, from fourteen to sixteen per cent. of nitrogen, the element on the presence of which vital action in animals seems mainly dependent. The existence of only 109 parts of gluten in the thousand of rye, of 87 in the oat, and of 60 in barley, places all these grains in an infinitely inferior grade to that of wheat of even the lowest cast in this respect. In the chemical process of fermentation, gluten fulfils an important function, hence the superior lightness of fine wheaten bread compared with that made from barley and rye, &c.

In agriculture and in commerce the varieties of wheat are often distinguished as red and white wheats, and hard and soft wheats. Such classification is altogether independent of value in a botanical point of view, however important the latter division may be as regards the economical adaptation of the particular kinds so denominated. Both of these distictions are more or less results of soil, climate, and other fortuitous circumstances, and are consequently liable to disturbance, or even inversion, under a change of treatment, especially when subjected to the same through several successive seasons. Colour, both in the grain and chaff, is peculiarly liable to change, red wheat becoming white, and *vice versâ*. The alteration of the texture of the grain, as from hard to soft, is a longer process, requiring, in most cases, the cultivation of several successive years; but it will be found by experiment no less certain than the change of colour—in fact, that none of the popular distinctive characters of our cultivated wheats are absolutely permanent, and therefore is it probable that they are, without exception, only so many forms of one original species.

The varieties grown in this country, and almost throughout Northern Europe, belong to the soft-grained class; the hard-grained requiring a warmer climate, or at least a higher mean summer temperature, are almost exclusively raised in the eastern parts of the Continent and in the countries around the basin of the Mediterranean. These latter varieties are usually far richer in gluten than the soft wheats, containing sometimes, it is stated, no less than thirty per cent. of that valuable proximate, the proportion of which seems to be enhanced by the warmth and dryness of the climate under which the grain is ripened.

The variety figured on plate CXXVIII as *Triticum compositum*, is seldom grown in England, unless as a subject of curiosity. It is supposed to have originated among the ancient Egyptians, and to be the one referred to in Pharaoh's dream as bearing seven ears on one stalk. The number of its associated ears or branches is liable to considerable variation; and the ears are often simple on stalks, from the same root that bears the compound ones, in which case they are indistinguishable from those of *T. Turgidum*, another of the many pseudo-species adopted by agricultural writers.

Wheat is no less liable than rye, and, indeed, all kinds of corn and other cultivated vegetables, to disorders associated with the development

of minute species of fungi; and though *ergot* is less frequent in its attacks upon it than is the case with the last-mentioned grain, several other equally destructive members of the class, known by the more familiar names of *smut*, *rust*, and *mildew*, seem always ready to avail themselves of every opportunity, that weakness engendered by adverse season or circumstances presents. Straw, foliage, husk, and grain afford in turn a subject, for their insidious depredations, which are always more or less injurious, not to the quantity alone of the crop, but to its nutritive and healthful quality. Instances of this deterioration are shown in the analyses of our agricultural chemists, as in that of blighted wheat, grown in 1804, by Sir H. Davy, which presented the average quantity of 955 parts of nutritive matter in the 1,000 reduced to 650, while a sample of mildewed wheat, in 1806, yielded only 210 in the 1,000. The consequence of using such wheat as food, especially the last-mentioned, would, of course, be a step toward starvation, even though no greater evil resulted. It is, however, well known to be highly prejudicial to health; and the higher standard of living among the poorer classes of our population, compared with those of some continental countries, is the only cause of their exemption from the dreadful disease mentioned above, as resulting from the use of bad rye. That such disease might occasionally prevail among them here from similar causes, under a more restricted form of diet, is evident from a record in the Philosophical Transactions for the year 1762. The case in question occurred in the village of Wallisham, about fifteen or sixteen miles from Bury St. Edmund's, Suffolk, and the report of it was forwarded to the Royal Society by Dr. Wollaston, attested by the Rev. Mr. Bone, the curate of the parish, and is, abridged, as follows:— Some of the wheat belonging to a farmer in the neighbourhood, being laid or beaten down by bad weather, and the grain much damaged in consequence, was collected and threshed apart from the remainder. Being unfit for the market, it was sold at a low price to any of the farm-labourers, and other people of the village who might be inclined to purchase. The sale of this corn commenced about Christmas, and to one poor family, whose chief, or possibly sole, support it was for some time, the result was most alarming and unparalleled. It appears that the consumption of the *clog-wheat* or *rivets*, as it is termed, by the father, mother, and five children, was about two bushels in the fortnight; the same being eaten in the form of bread and puddings, both of them very indifferent in quality. But to poverty, cheapness, and sufficiency of food are always irresistible inducements, and this unwholesome fare was continued, without intermission, until the mother and her children were attacked, within a very few days of each other, with *gangrenous ergotism*. The first indication of the disease, intense pains in the lower limbs, occurred on the 10th of January, which were probably mistaken for rheumatism; and when these subsided within the course of the week, numbness and insensibility of the parts succeeded, terminating in mortification. The condition of the family, at the time Dr. Wollaston made his report to the society, is here subjoined:—

"Mary, the mother, aged forty. Right foot off at the ankle; left leg mortified, a mere bone, but not off.

"Elizabeth, aged thirteen. Both legs off below the knees.
"Sarah, aged ten. One foot off at the ankle.
"Robert, aged eight. Both legs off below the knees.
"Edward, aged four. Both feet off at the ankles.
"An infant, aged four months. Dead.

"The father was not attacked until about a fortnight after his wife and children, and in a slighter degree. In him the pain was confined to two fingers of his right hand, which turned blackish, and withered. Another labouring man, in the same parish, who had eaten of this bread, suffered from numbness in both his hand for above a month. They were constantly cold, and his finger-ends peeled; one thumb, he says, remains without any sensation."

In several instances, where bread made from the same corn was eaten in the farmer's own family, as well as by other persons, no prejudicial effects were noticed, probably in consequence of such bread being only occasionally used, and as an adjunct to other wholesome and nourishing food. The nature of the disease with which the wheat was affected, in this lamentable case, does not appear to have been ascertained; but the circumstances are well authenticated, and were in my boyhood, the early part of the present century, the subject of local tradition in the part of the county of Suffolk in which they took place. It is possible that the fatality attendant upon the use of the damaged grain, in the unfortunate family above mentioned, arose quite as much from the absolute deficiency of proper nourishment, as from the alleged poisonous quality of the mildewed fungus; but, with such examples before us, too great caution cannot be enforced regarding the use of grain or flour of suspicious character.

The great superiority of wheat, as dependent on its large proportion of gluten, will be readily understood, when it is remarked that the chemical composition of that proximate principle is identical with that of good ox-beef. And when we learn that the quantity of gluten found in rice scarcely exceeds one-half that belonging to barley, or is little more than three per cent., we may at the same time comprehend how much a difference in their staple articles of diet, has contributed to the exaltation of the nations of Europe above the rice-feeding population of India and China. Starch, the other leading constituent of all kinds of grain, gives substance to the human frame; but its strength and activity, as well mental as corporeal, are only maintained by food, of which the nitrogenous element is a compound.

Several other species or varieties of wheat, little known in England, are cultivated in Germany, Poland, and elsewhere on the Continent. Of these, *T. polonicum*, the Polish wheat, is unquestionably one of the latter class, a mere inferior variety of *T. sativum*, with smaller ears, and having three-flowered instead of four-flowered spikelets. The others, collectively called spelts, or spelter-wheats, are probably varieties of a distinct species.

T. spelta, common spelt wheat, is largely grown in Southern Germany, where it is so much liked as, in some districts, almost to exclude other wheat from the markets. Being all but indifferent to soil and situation, and, from the shortness and stiffness of its culm, not readily

laid in tempestuous weather, are great recommendations to the farmer, in a country where agriculture has little advanced from the earliest periods.

T. dicoccum, two-grained, or rice-wheat, and *T. monococcum*, one-grained wheat, are apparently varieties of the foregoing, and are often cultivated on the same lands. Their produce in grain is comparatively small; but it has, in either case, qualities that habit has rendered agreeable. The last is a favourite corn among the Swiss, who seem to have a similar predilection for it as our northern country people have for oats and barley.

Agropyrum. Beauvois.

Perennial. Spikelets not ventricose, several-flowered. Glumes and paleæ lanceolate, or linear-oblong.

Triticum cristatum. Crested Wheat Grass. Plate CXXIX.

Spike-flattened, closely imbricated. Spikelets four- or five-flowered. Glumes subulate, with a terminal awn. Outer paleæ with an awn about its own length. Rachis slightly downy. Leaves hairy above. Culm rough.

Triticum cristatum, *Schreber*. Most English botanists. *E. B.* 2267. ed. 2. 180. Agropyrum cristatum, *Beauvois*. *Lindley*. Bromus cristatus, *Linnæus*.

We have not any national claim to this grass, which, though discovered many years ago by the late Mr. G. Don, growing on the east coast of Scotland, "on steep banks and rocks," between Arbroath and Montrose, seems not to have been found by any more recent botanists. Its introduction in the present work is due to an oversight in making out the list of plates from those of the 'English Botany,' in which it was figured from specimens forwarded at the time of its discovery. On the same authority it retains a place in most of our descriptive catalogues and manuals of the British Flora, probably on the plea that having been once met with in this island, accidentally introduced, it may again occur as a natural visitant.

Cultivated in the botanic garden, the stems average a foot or more in height, being hairy and rough to the touch. Leaves linear-acuminate, hairy on the upper surface, with a very short obtuse ligule. Spike compressed, linear, or tending to ovate, seldom more than an inch in length; spikelets closely imbricated on each side of the rachis, sessile, four- to six-flowered. Glumes more or less lanceolate or subulate, terminating in a long point or awn, which is an extension of their middle vein. Outer palea awned like the glumes from the apex; inner fringed on the margins.

Perennial. Flowers in July.

The general aspect of this grass is at first sight not very unlike that of *Hordeum maritimum*, but the generic characters will readily distinguish them, especially the association of the spikelets of the latter, which are never more than single-flowered, in clusters of three, while in *Triticum* the spikelets are solitary and several-flowered.

The Crested Wheat Grass is strictly indigenous to the north-eastern portion of our continent, and according to Gmelin is common throughout Siberia.

TRITICUM JUNCEUM. Rushey Sea Wheat Grass. PLATE CXXX.

Spike interrupted. Spikelets distant, rather spreading, four- to six-flowered. Glumes obtuse, many-ribbed. Outer palea obtuse, smooth, five-veined. Rachis smooth, brittle when in fruit. Leaves involute, pungent, downy above. Root creeping.

Triticum junceum, *Linnæus*. *E. B.* 814; ed. 2. 177. Generally adopted.

Very common, growing among the loose sand on our sea-shores, which its creeping roots and stolones assist in fixing. Flowering stems a foot and a half to three feet high. Whole plant glaucous, and usually smooth, except on the inrolled upper faces of the leaves, which is more or less downy, especially on those of the stem. The leaves are of a rigid texture, and from their involute character, so acute as to be almost spine-like at the apex. Spike very long, and, owing to the distance of the spikelets from each other, interrupted. Rachis smooth, often almost polished, becoming brittle or disarticulating at the joints as the fruit ripens. Spikelets oval-oblong, generally about five-flowered. Glumes obtuse, but often apiculate from the extension of the middle vein beyond the apex; the veins so elevated as to assume the appearance of ribs. Outer palea obtuse, smooth, five-veined, the middle vein frequently extending into a mucro, as in the case of the glumes, but never forming a positive awn.

Perennial. Flowers in July and August.

This is a very variable species, being apparently much influenced by difference of locality and other circumstances. The varieties, so called, are undeserving of notice, as not any of them are permanent, and this is the case with *Triticum laxum*, Fries, of Mr. Babington's Manual. It is even doubtful whether the plant before us is itself a species distinct from the following *T. repens*. Mr. Bentham regards them as belonging to the same type, and taking into consideration the glaucous maritime variety of the latter, *T. littorale*, Host, the transition between the two extreme forms of both is all but imperceptible; the differential characters, are founded upon features too unimportant and inconstant to be placed in competition with the striking uniformity of habit and general structure appertaining to the entire series.

TRITICUM REPENS. Creeping Wheat Grass. Couch Grass. Squitch. Spear Grass. PLATE CXXXI.

Spike elongated, compressed. Spikelets more or less imbricated and erect, four- to eight-flowered. Glumes acuminate, many-ribbed. Outer palea acuminate, five-veined. Raehis rough at the angles. Leaves plane, or tending to involute, roughish, with a single row of hairs or points on the veins on the upper side. Root creeping.

Triticum repens, *Linnæus*. *E. B.* 909; ed. 2. 178. Most English botanists. Agropyrum repens, *Beauvois*. *Lindley*.

Common in all parts of the kingdom, especially in arable land, where owing to its creeping habit, it is among the most troublesome of weeds. Its long, underground stems penetrate the loose soil in every direction, and when once they have possession, are very difficult to eradieate, as, broken up by the plough or spade, every fragment vegetates apart, thus renewing or extending the crop. Few plants exhaust the ground so rapidly of nutritive matter, and it can only be got rid of by repeated fallowing or laying down to pasture. In gardens frequent disturbance of the soil by digging or forking, and removal by the hand or rake of the upturned runners, afford the only means of destruction. The fibres of the roots are downy; the erect, flowering stems rise to the height of two or three feet, being comparatively slender, smooth, and striated, the leaves on which are frequently all directed to one side. Leaves dark green; in the more common form of the plant marked above, with more or less conspicuous parallel lines of hairs or points along the principal veins. Ligule short, obtuse. Spike compressed, six to eight inches in length. Spikelets oval or oblong, varying from four- or five- to seven- or eight-flowered. Glumes very acute, the apex in some instances extending into a short awn, many-ribbed, or veined. Outer palea very acute, and even slightly awned, though never so prominently as in *Triticum caninum*, the awn scarcely exceeding half its own length.

Perennial. Flowers from June to September.

The creeping stems of this grass, so pernicious and troublesome in cultivation, are succulent, sweet, and very nutritive. They are greedily devoured by horses and cows, although these animals never eat the leaves unless at their first appearance in the spring. In the south of Europe, the peasants collect them from the road sides and waste grounds in large quantities, for the purpose of carrying them into the town-markets as horse-food. Considerable profit is made by the poor about Naples in this way. The flavour is somewhat similar to that of liquorice-root, and Sir H. Davy found that they contained about three times the amount of nourishment that exists in the leaves and stems. Withering informs us that "when dried, and ground to meal, they have been made into bread in years of scarcity;" adding that "the juice of

them drank liberally is recommended by Boerhaave in obstructions of the viscera, particularly in cases of schirrous liver and jaundice." Dogs and cats eat the leaves both of this and the following species to excite vomiting, whence they are both of them known in many parts of the country by the common name of Dog-grass; the effect produced, however, seems to be rather mechanical than medicinal.

Triticum repens is widely distributed over Europe and Northern Asia; in the former, especially, extending throughout the continent from Lapland to the shores of the Mediterranean, on the opposite side of the basin of which it grows in the north of Africa. The maritime variety referred to above, under *T. junceum*, is chiefly distinguished from the common form by its glaucous hue and more or less awned flowers.

TRITICUM CANINUM. Bearded Wheat Grass. Dog-wheat. PLATE CXXXII.

Spike elongated, more or less compact. Spikelets imbricated, erect, three- to five-flowered. Glumes acuminate, usually three-ribbed, with a short terminal, rough awn. Outer palea acuminate, five-veined, terminating in a long, slender, rough awn, longer than itself. Rachis rough at the angles. Leaves plane, rough on both sides. Root fibrous, clustered.

Triticum caninum, *Hudson. E. B.* 1372; ed. 2. 179. Most English botanists. Agropyrum caninum, *Beauvois. Lindley.*

Frequent in woods and on hedge-banks, but far less common than *Triticum repens*. The stems grow more or less tufted, not at comparatively long distances like those of the latter, varying in height, according to circumstances, from two to three or four feet. Leaves glossy, dark green, acute, roughish on both surfaces. Ligule short, obtuse. Spike long and slender, often compact and somewhat subcylindrical. Spikelets usually four- or five-flowered, occasionally only two-flowered. Glumes distinctly three-ribbed, with a terminal awn variable in its proportional length. Outer palea, acuminate, five-veined, more or less hairy, terminating in a slender rough awn, generally much longer than itself.

Perennial. Flowers in July.

The geographical distribution of this grass accords with that of *T. repens*, but it is less predominating in its habit. It yields, in favourable localities, a tolerable crop of early herbage, which is apparently relished by cattle in general; hence it is recommended by some agricultural writers for sowing on soils of inferior quality instead of Ray-grass, *Lolium perenne*, but its value for such purpose does not appear to be established by the result of experiment. A grass, growing naturally in sheltered situations, moist woods and thickets, is ill adapted for culture in meadow and pasture land.

Independent of difference in habit, *T. caninum* has so many features in common with *T. repens*, or rather is separated from it by characters so questionable, and so liable to modification, that the specific identity of the two is far from being undeniable. At present they are regarded as distinct, and this assumption is warranted by their varied form of growth; but, whether we are justified in associating such variation with the rudimental dissimilarity of structure upon which the separation of species should depend, requires further insight regarding vegetable physiology than we at present possess.

Genus 43. BRACHYPODIUM. False Brome Grass.

Gen. Char. Inflorescence racemose as to the disposition of the spikelets. Spikelets solitary, linear, subcylindrical, many-flowered, diverging from the rachis, toward which their sides are directed. Glumes two, opposite, unequal. Paleæ two, rounded on the back; the outer one pointed or awned at the extremity; the inner one retuse, coarsely fringed on the upper part of its ribs or veins.

The genus is one of comparatively small extent, founded by Beauvois for the reception of certain previously anomalous species of *Triticum*, *Bromus*, or *Festuca*. The unequal glumes, long subcylindrical spikelets, and coarsely-fringed ribs of the inner palea distinguish it from *Triticum;* the sessile spikelets and terminal awn or point of the outer palea from *Bromus*, and the first of these latter characters from *Festuca*, the equivocal *F. loliacea* excepted, with which, however, it is not at all liable to be confounded.

The species are collectively destitute of agricultural value, being disliked by sheep and cattle, and, indeed, rarely eaten by any herbivorous animals.

The name is not well chosen, being compounded from the Greek *brachys*, short, and *pous*, a foot, in allusion to the short stalks of the spikelets; the latter being so nearly sessile as to render the presence of pedicels often very doubtful.

Brachypodium sylvaticum. Slender False Brome Grass. Plate CXXXIII.

Inflorescence slightly drooping. Spikelets solitary, alternate, somewhat secund, nearly cylindrical. Awns of the upper flowers longer than their paleæ. Leaves flat, linear-lanceolate, flaccid. Root fibrous, tufted.

Brachypodium sylvaticum, *Beauvois. E. B.* ed. 2. 182. Most modern botanists. Festuca sylvatica, *Hudson. Withering. Smith.* Bromus sylvaticus, *Pollich. E. B.* 729. Triticum sylvaticum, *Mœnch. Parnell.*

Not unfrequent in rather moist woods and damp shady places under hedges, throughout the kingdom. Stems one or two feet high, seldom more than two or three from the same root, often solitary, erect, slender. Leaves flaccid, more or less hairy above, flat, rather broad, so as to be linear-lanceolate. Ligule obtuse. Inflorescence rather nodding than drooping; the rachis smooth, zig-zag, but not toothed nor indented. Spikelets alternate, distantly inserted, an inch or more in length, according to the flowers varying in number from eight to fifteen or sixteen, rather inclining to one side, cylindrical at first, but eventually becoming more or less compressed. Glumes acutely lanceolate, seven-veined, more or less hairy. Outer palea, linear-lanceolate, usually hairy, seven-veined, with a long straight rough awn extending from the summit; inner palea rather shorter than the outer, very obtuse, with two green nearly marginal veins strongly fringed or ciliated above the middle.

Perennial. Flowers in July.

BRACHYPODIUM PINNATUM. Heath False Brome Grass. PLATE CXXXIV.

Inflorescence erect. Spikelets solitary, alternate, distichous, nearly cylindrical. Awns of the upper flowers shorter than their paleæ. Leaves flat, linear-lanceolate, rigid. Root creeping.

Brachypodium pinnatum, *Beauvois. E. B.* ed. 2. 183. Most modern botanists. Festuca pinnate, *Hudson. Withering. Smith.* Bromus pinnatus, *Linnæus. E. B.* 730. Triticum pinnatum, *Mœnch. Parnell.*

Occassionally met with throughout England, and not uncommon on open fields and heaths, especially over chalk and limestone. The root is somewhat creeping, but scarcely to be regarded as even approaching to stoloniferous. Stems more or less decumbent at the base, rather slender, erect, and rigid. Leaves linear-acuminate, more or less hairy, rigid. Ligule short, obtuse. Inflorescence erect, rigid; the rachis rough. Spikelets long, linear, cylindrical, usually erect or less divergent than those of *B. sylvaticum*, ten- to fifteen- or twenty-flowered. Glumes smooth, seven-veined, the middle vein occasionally prolonged into a short awn. Outer palea rough, seven-veined, the middle vein extending as a terminal rough awn seldom more than half the length of the palea, and often very short; inner palea very obtuse, with a green intromarginal vein on each side, fringed or ciliated with white bristles above the middle.

Perennial. Flowers in June and July.

The distinguishing features of this and the preceding are far from being decided, though botanists generally seem inclined to regard them as separate species. Cultivated in the same soil, and equally exposed, they appear to closely approximate each other in the course of a few

years, nor can the differences above detailed be considered in any other light than as results of diversified natural habitat. The varieties of the so-called *B. pinnatum* described by some authors are certainly not permanent.

Genus 44. LOLIUM. Darnel Grass.

GEN. CHAR. Inflorescence interruptedly spicate. Spikelets solitary, three- or more-flowered, arranged edgewise alternately on opposite sides of the rachis, quite sessile. Glumes solitary, or if two the one next the channeled face of the rachis small, or rudimentary.

A small genus distributed over the more temperate regions of the northern hemisphere. Some of the species are valuable as pasture grasses, but one, *Lolium temulentum*, presents a marked exception to the generally wholesome qualities of this valuable tribe of plants.

The name is of very doubtful origin, but was applied by the Romans to the species above mentioned; the injurious properties of which seem to have been known to the inhabitants of Europe and Asia from time immemorial.

LOLIUM PERENNE. Perennial Darnel. Ray Grass. PLATE CXXXV.

Spikelets six- to twelve-flowered, much longer than the solitary external glume. Lower palea usually awnless. Root producing leafy barren shoots.

Lolium perenne, *Linnæus*. *E. B.* 315; ed. 2. 184. Generally adopted.

One of the most common and abundant of British grasses, growing almost everywhere, and without limitation to soil, throughout the kingdom, not only in meadows and pastures, but on waste places and roadsides, varying much in size and general appearance according to circumstances. As a meadow-grass, the flowering-stems, more or less decumbent at the base, attain the height of one or two feet; but in hard ground, especially where liable to frequent treading, reach only a few inches. Leaves dark-green, rather broad, those of the stem approaching to lanceolate, flat, rough on the upper face, smooth below. Spike usually flattened, but occasionally almost cylindrical; differing in the breadth and divarication of the spikelets, sometimes branched, six inches to a foot in length. Spikelets sessile, in starved specimens three- or four-flowered; in luxuriant ones, ten- or twelve- to sixteen- or even twenty-flowered. Glume oblong-lanceolate, rigid, awnless, strongly five-ribbed, smooth, shorter than the spikelets; where the latter are

divaricated or spreading outward from the main rachis, a second small inner one is sometimes, indeed not unfrequently, present. Paleæ two, equal, usually awnless; the outer one smooth, five-veined, membranaceous; the inner one linear, with two green marginal fringed veins.

Usually considered to be perennial, but doubtfully so. Flowers from June to September.

The varieties, natural and cultivated, seem all but unlimited; among the former may rank *Lolium linicola*, Sonder. E. B. Supp. 2955. *L. multiflorum* of the British Flora, and *L. tenue;* among the latter, *L. Italicum*, Braun, the Italian Ray Grass, or rye grass of agriculturists. The last is strikingly distinguished from the other forms of *L. perenne* by the long slender awns of the flowers; but does not appear to have any claim to be considered as a species, though its origin is unknown.

No species of grass has ever attracted so much interest amongst our agriculturists as that now before us, and, especially in the more recent times, when it has become one of the most important agents of the "convertible system of husbandry." Its fame, however, is of long standing. The earliest mention of its cultivation in England is by Dr. Plot, the learned author of 'The Natural History of Oxfordshire,' published in 1677, and that of 'Staffordshire' at a later period. In the former work he observes: "They have lately sown ray grass, *gramen loliaceum*, to improve cold, sour, clayey, weeping ground, unfit for saint-foin." It was first sown in the Chiltern district of the county in question, and afterwards at Islip, by a person of the name of Eustace.

Being the first pasture grass, apparently, artificially grown or cultivated by Europeans, its value for the purpose was probably previously enhanced beyond its due estimation, whence doubts are frequently entertained by practical farmers respecting the high encomiums that are lavished upon it by some agricultural writers. I believe that a careful investigation of the subject would tend to invalidate much of the abuse occasionally bestowed upon this grass, and to remove the doubt as to its relative value in farming; both of which are due to its mistaken application; and are, farther, the result of absence of method in adapting practice to circumstance. So much is expected of and required from it, that it does not always answer the demand. To determine whether we are justified in this assumption, let us examine a little into the character and capabilities of the species, and summon to our aid a few witnesses to both, selecting the latter from different periods in the history of its cultivation. In the first place let it be well understood that there is not any grass more liable to variation in durability, produce, or nutritious properties than this; which is, in some soils and situations, perennial, in others biennial, or even annual—here it is redundant in the development of herbage, there thin and deficient. In one form it is succulent and foodful, in another wiry, harsh, and meagre.

Stillingfleet, writing about a century ago, informs his readers that "this grass is well known and cultivated throughout all England; and it is to be hoped the success we have had with it will in time encourage our farmers to take the same pains about some others that are no less

valuable, and are full as easy to be separated. It makes a most excellent turf on sound rich land, where it will remain,"—but on the following page he adds: "many are tempted by the facility of procuring the seeds of this grass to lay down grounds near their houses, where they want to have a fine turf with it; for which purpose, unless the soil be very rich, a worse grass cannot be sown, as it will certainly die off in a very few years entirely."

Swayne, the author of the 'Gramina Pascua,' as quoted by Withering, observed, "there was reason to think that the common cultivated Ray-grass had by constant sowing degenerated from its natural qualities, that it was inferior in many respects to the Ray-grass growing naturally in our best meadows and pastures. Mr. Pacey, an enlightened agriculturist, in the upper part of this county (Staffordshire), has lately raised a variety of Ray-grass from seed selected from old pastures, and has now multiplied it to that extent as to sell annually a considerable quantity at the price of 10s. 6d. per bushel. It has been proved by the most competent judges to be infinitely superior to the cultivated Ray-grass, and he has a demand for all he raises. What," he adds, "can be the cause of the degeneracy of the cultivated sort?"

The foregoing remarks, from writers of the past century, are sufficient to show that similar disappointments to those now in store for the careless cultivators of this grass prevailed among the experimental farmers of that period, and induced the more scientific to enquire into their causes and endeavour to remedy them. The introduction of the Pacey grass, as it is still called, was a grand move in the earlier career of agricultural improvement; and the sale of the seed in large quantities at the recorded price probably well remunerated its spirited producer. A strong proof of its value is, that among the numerous other varieties to which the attention of the farmer has since been directed, Pacey's grass still maintains a high position. The varieties in question, including those of natural growth, are not much under seventy.

The liability to degenerate, at first mysterious, or incapable of being accounted for, is now no longer so; systematic enquiry and observation have solved the question. No grass so rapidly impoverishes the soil, or rather takes from it that which is necessary to its own support to an extent equally prejudicial to its future growth; and when the nutriment in question is exhausted, it dwindles and dies off. Why one variety should endure only a single year, while another flourishes five or six, cannot be positively determined; though enquiry would probably explain the phenomenon as dependent upon certain constitutional differences, which, at first induced by peculiar circumstances, are retained from generation to generation, like the varied habits, forms of disease, and other idiosyncracies appertaining to families and races in the animal kingdom.

Analyses are wanting to show the relative proportions of nutritive proximate elements, as starch, sugar, mucilage, &c., in the different varieties of *Lolium perenne;* but it is certain that those proportions are greater in the semi-annual, or short-lived and quickly-assimilating kinds, than in those of slower growth and longer duration. In adopting any general comparisons between the productive and nutritive

capabilities of the Ray-grass and other agricultural species, this fact must not be lost sight of any more than the character of the soil in which the samples have been grown. Such estimates, indeed, however worthy of credit may be the authority under which they are put forth, should always be received with caution; not so much as being liable to error in the experiments on which they are founded, as from the conditions of those experiments being different to the circumstances under which we are depending for corresponding results. Admitting the possibility of the latter to a limited extent, it may be stated that, as a permanent pasture grass, *Lolium perenne* is of a much lower rank than several other very common species; and, that estimating the value of *Dactylis glomerata*, the Rough Cock's-foot, at eighteen; that of *Festuca pratensis*, the Meadow Fescue, at seventeen; and that of *Alopecarus pratensis*, the Meadow Fox-tail, at twelve, the common Ray-grass would stand only in the relative proportion of five. Dr. Parnell, quoting these comparisons, observes:—"The Rye-grass is but a short-lived plant, seldom remaining more than six years in possession of the soil; but is continued by its property of ripening an abundance of seed, which is but little molested by birds, and suffered to fall and vegetate among the root-leaves of the permanent pasture-grasses."

It is exclusively in the successional system of cultivation, and in a few isolated instances apart from it, and dependent upon peculiarity of soil and situation, that the importance of the grass before us is chiefly manifested. It readily vegetates, from seed easily collected, on almost every kind of soil, quickly arrives at maturity, and produces a plentiful supply of early herbage, before the young plants come into flower. In the spring it is, therefore, highly valuable, being greatly relished by cattle, by which, however, the rigid flower-stems are always left untouched; and, unless these latter are removed by timely mowing, the after-crop is nearly worthless, the foliage dying away as the seed approaches maturity.

A variety of Ray-grass, introduced from the Continent, came into use among our farmers generally about five-and-twenty years past, and appears to be one of the most valuable of its kind. Although long cultivated in southern Germany, the south of France, and Switzerland, it originated on the plains of Lombardy, and hence has received the name of Italian Ray-grass, or *Lolium Italicum*. It differs from the more common varieties in having the spikelets very conspicuously bearded, the flowers being all terminated by long slender awns, a feature so striking as to have induced some botanists to regard it as a distinct species. The great value of this grass consists in its being of more rapid growth from seed than any of the other kinds, and in the quantity of fine close herbage it produces under favourable circumstances; but a moist, rich soil, and means of copious irrigation, are requisite to elicit these properties to the full extent. The peculiar situation and condition of its birth-place in Northern Italy, broad, level, pasture lands, open to periodical inundation from the mountain-fed streams and rivers by which they are intersected, have conferred upon it this character; and, though a corresponding one is maintained

in our colder climate under an imitative treatment, or similar flooding of the land, in poor, dry soils, it either fails altogether, or resumes an aspect approaching the wild uncultured state from which it has originally become modified.

Under the "convertible system of husbandry," or that of alternate cropping, the Italian Ray-grass is often sown with clover, especially with the beautiful and highly productive species of southern Europe, *Trifolium incarnatum*, or with other kinds of grasses; either to be consumed as pasture, or for cutting and carrying off the ground as green food, or otherwise to remain for mowing as hay; in all cases, with a view of improving the land for corn crops. In most instances it has been found to add greatly at first to the quantity of herbage, but the effect soon diminishes. The water-meadow seems to afford the widest scope for its capabilities, as being the nearest approach to its natural habitat, and most accordant with the circumstances under which it originated. So active is its vegetative power, when stimulated by abundant moisture and the other consequences resulting from river inundation, that, in Switzerland, hay is said to have been made in July on a newly-made water-meadow sown with Italian Ray-grass in the March previous. But its value is only temporary, as when this highly-productive grass "is sown by itself, and allowed to go to seed, it becomes thin after the first year, from many of the plants dying off; it may, therefore, be prudent to mix other kinds of grasses with it, which will supply its place when it is worn out. It is a most excellent practice to sow Italian Ray-grass on old meadows and pastures at the time when they are recruited with compost or fresh earth. If they are well harrowed and scarified, and the Ray-grass be sown before the roller goes over them, the succeeding crop of hay will be much increased in quantity and improved in quality." The effect in the first year after sowing is exceedingly striking to a person observing it for the first time: the only question to be considered is the additional expense and the accompanying possibility of the return not being equivalent, which in some situations would be the case, especially where the soil is naturally dry, and capability for irrigation is not at hand.

Those who would depreciate the value of Ray-grass, and decry its use in farming on the existing system, quarrel especially with the absence in it of a strictly perennial character. But, considered in its proper place, or merely as an *artificial* grass adapted only to peculiar circumstances, its worth cannot be reasonably disputed. Other species of grass may be more extensively applicable; but this is one, that, of small account in its original state, culture has modified—has, indeed, it may be said, forced into unnatural productiveness. Ought we to be surprised, that a plant so conditioned should fail, when the stimulus that first wrought the change is exhausted or withheld? The cause of the failure of which some practical agriculturists complain is, that they have required and expected nature to maintain that which nature does not acknowledge, a property that we have *induced*, but which she has not *bestowed*.

As an uncultured pasture grass, the *Lolium perenne* holds, perhaps,

a very subordinate rank; but admitting this to be the case is not denying its utility in other respects.

It is a circumstance worthy of remark, as associated with the natural history of this grass, that, although producing abundance of seed, the latter should rarely, from my own observation I should say *never*, be consumed by granivorous birds. Is it not indicative of the presence of some deleterious property prevailing in them, approaching that which distinguishes those of the following species? The fact that cattle generally, if not always, leave the mature flowering stems untouched on the pasture, though they greedily crop the young foliage, seems no less significant.

LOLIUM TEMULENTUM. Annual Darnel. Bearded Darnel. True Ray-grass. PLATE CXXXVI.

Spikelets five- or six-flowered, shorter than the solitary external glume. Lower palea awned. Root fibrous.

Lolium temulentum, *Linnæus*. *E. B.* 1124; ed. 2. 185. Generally adopted.

Common in corn-fields, especially throughout England, and chiefly among wheat and barley, with the seeds of which it has been introduced from the Continent. Stems erect, about two or three feet in height, but varying according to that of the corn among which they grow; usually many from the same root, never sending out from the base leafy barren shoots like those of the preceding species. Leaves flat, acute, rough on both sides, especially toward the upper extremity. Ligule short, obtuse. Spike six inches to a span or more in length. Spikelets sessile, seldom more than five- or six-flowered, rarely exceeding the external glume in length. Glume linear or oblong, strongly three-ribbed with intermediate veins, generally a little longer than the spikelet, on the inner face of which the rudiment of a second is, in most instances, observable, and sometimes so much developed as to partially interfere with the generic character. Paleæ two; the outer one seven-veined, with a rough awn extending from below its bifid extremity; inner one linear, with two green marginal fringed veins. Awn very variable in length, but in general about half that of the palea; sometimes much longer, and rarely absent altogether.

Annual. Flowers in July and August.

LOLIUM ARVENSE. White Darnel. PLATE CXXXVII.

"Spikelets awnless, rather shorter than the calyx (glume). Calyx two-valved. Straw smooth."

Lolium arvense, *Withering*. *E. B.* 1125. L. temulentum β, Modern botanists.

A mere variety of *L. temulentum*, growing in similar situations, and only distinguished from it by the smoother habit, conspicuous presence of the inner short glume, and absence or short hair-like character of the awn; from the pale or hoary hue of which latter, when present, Dr. Withering seems to have adopted the above English name.

Lolium temulentum is widely spread, as a weed of cultivation, throughout Europe and central Asia, having apparently followed everywhere the introduction of those grains among which it still all but exclusively vegetates. The Latin specific name denotes the peculiar intoxicating property of the seeds, either taken as food, or employed in the preparation of fermented liquors, a circumstance probably well known to all the agricultural peoples of the northern hemisphere, from the earliest periods of their history. Evidence of such knowledge may be gathered from the use of it being prohibited by the laws of China; while numerous instances occur in the writings of the earlier European authors which indicate familiar acquaintance with the properties in question. The ultimate effects are, on the broad scale, not very dissimilar to those produced by diseased or ergotized grain; but they commence with head-ache, dizziness, imperfect vision, and other symptoms of intoxication—hence the old proverb, "he feeds on Darnel," applied to an imprudent or short-sighted person, and alluded to by Plautus in one of his comic dramas written about two centuries before the Christian era. It is generally considered by commentators that the word *zizania*, occurring in the parable in the 13th chapter of St. Matthew, translated from the Greek version as *tares* sown by an enemy among wheat, refers to Darnel. The word is not Greek, but a Greek-rendering of the Syriac *zizana*, whence the present Arabic and Turkish name of this noxious and troublesome weed, *zuwan*. The manner in which it is still separated from the wheat in some parts of Syria, drawing up both together by the hand, and afterwards collecting the Darnel stems in bundles apart from the corn, is perfectly consistent with the close of the parable in verse 30.

Many cases are recorded, in medical works, of poisoning by Darnel. The seeds, ground and made into bread, with a small proportion of wheat or other flour, and eaten in this manner repeatedly, produce vomiting, purging, attended by giddiness, pain and swelling of the limbs, and eventually gangrene and death. A small farmer near Poictiers, in France, died in consequence of persevering in the use of bread so circumstanced, while his wife and servant, who discontinued to eat it after the earlier symptoms, recovered. In some instances people have lost their limbs by subsisting on meal in which any considerable quantity of Darnel grain was commingled. About thirty or forty years back, according to Christison, "almost the whole of the inmates of the Sheffield workhouse were attacked with symptoms supposed to be produced by their oatmeal having been accidentally adulterated with *Lolium*." Linnæus states that the seeds, mixed with bread-corn, produce but little effect, unless the bread be eaten hot; but, if malted with barley, the ale soon occasions intoxication. This latter effect is said to have occasioned its not-unfrequent use by fraudulent brewers and publicans in England, and, although no evidence is advanced in

support of such statement, it is far from improbable that experiments of the kind have been made. Professor Burnet, in his "Outlines of Botany," published in 1835, informs us, that "a few years ago two acres of ground in Battersea Fields were sown with this grain,"—adding, "to what good purpose it could have been applied is unknown, for, although Darnel meal was once recommended as a sedative cataplasm, it has long been disused." The crop to which he refers was visited by myself, and specimens selected from it are still in my possession, as well as from two other fields in Surrey, the property at the time being in the possession of one of the partners in a well-known London firm. This was more than twenty years past, and I have not since met with the plant in any other position than that of an agricultural weed.

Our English name of Ray-grass is a corruption, or rather contraction of the French *ivraie*, from *ivre*, drunk, bestowed on the species in allusion to its intoxicating effects. The seeds of *Lolium perenne*, being supposed harmless in this respect, the latter is often denominated *fausse ivraie*; their actually wholesome character seems, however, as remarked under our notice of the species, very doubtful, although growing in situations where it does not interfere with human health, the presence of any corresponding quality has hitherto escaped observation.

Most English writers, botanical as well as agricultural, apply the name of Rye-grasses to the species of this genus, an orthography liable to mislead, as there is no foundation for such title beyond the belief of the peasantry in some rye-growing countries, that rye is apt to degenerate into Darnel; a supposition equally prevalent in regard to wheat and barley, among the ignorant in lands where the *Lolium temulentum* is more common than it is with us.

The only well-authenticated instance of actually poisonous character in grasses is that of the one before us; though certain species of *Bromus*, *Festuca*, and other genera, are said to be unwholesome, and some tropical grasses have the repute of proving fatal to cattle that feed upon them.

Genus 45. LEPTURUS. Hard Grass.

Gen. Char. Inflorescence spicate. Spike solitary, slender, cylindrical, zigzag, jointed, eventually separating at the joints. Spikelets solitary in each joint, alternately imbedded on opposite sides of the rachis, one- or two-flowered. Glumes one or two, cartilaginous, ribbed, collateral, on the opposite side from the rachis, covering the flowers. Paleæ of the fertile flower, two, scarious, awnless.

One of the glumes, anomalous in position as regards the spikelet, both being placed outwardly, may be considered as the representative of a second spikelet, the flower or flowers of which are undeveloped.

The genus is a small one, not very well defined, and presents only a

single British species. The name, from the Greek, *leptos*, slender, and *oura*, a tail, alludes to the extreme slenderness of the spike, which is not thicker than the stem it terminates. By some botanists the species are confounded with those of *Ophiurus*, snakes'-tail, or of *Rottbœllia*. Though few, they have a wide distribution.

LEPTURUS INCURVATUS. Sea Hard Grass. PLATE CXXXVIII.

Spike cylindrical, subulate. Glumes two.

Lepturus incurvatus, Trinius. *Hooker and Arnott. Babington. Bentham.* Rottbœllia incurvata, *Linnæus. E. B.* 760; ed. 2, 186. *Parnell.* Ophiurus incurvatus, *Beauvois. Lindley. Loudon.* Ægilops incurvatus, *Linnæus.* Sp. plant.

A very frequent grass in salt marshes on the coasts of England and Ireland, but comparatively rare on those of Scotland. Stems decumbent and much branched from the base, curving upwards toward the time of flowering, smooth, bent at each joint, varying in length from two or three inches to nearly a foot according to the character of the soil. Leaves narrow, acute, more or less involute. Inflorescence continuous with the stem, and scarcely distinguishable from it except when the flowers open, cylindrical, spike-like, more or less curved or straight, two to four inches long. Spikelets alternately disposed on the rachis, in the depressions or cavities of which they are imbedded, being covered externally by the closely appressed glumes; of the two flowers, one is almost universally barren, and little more than rudimentary. Glumes flat, linear-lanceolate, acute, four-ribbed, or veined, very rigid. Paleæ thin, membranaceous, linear, neither veined nor awned. When the seed is ripe, in place of the grain being shed, the rachis disarticulates at the joints, and thus fulfils its dispersion.

Annual. Flowers in July and August.

A very slender variety, in which the stems are erect, and the spike not at all curved, is met with in sandy soils, but far less commonly than the normal form. It is the *Lepturus filiformis* of Trinius, *Rottbœllia filiformis* of Roth, and was once regarded as a distinct species.

Only valuable as a colonizer.

Genus 46. KNAPPIA. Knappia.

GEN. CHAR., Inflorescence sub-spicate, unilateral. Spikelets shortly-stalked, arranged in two series, but pointing to one side; single-flowered. Glumes two, equal, opposite, truncate, smooth, membranaceous, single-veined. Outer palea hairy, obtuse, torn at the apex, membranaceous; inner narrower, generally absent, or very small.

A single species, common to the sandy pastures of southern and western Europe, especially toward the Atlantic and Mediterranean coasts, constitutes this genus. Named by Sir J. E. Smith after Mr. M. Knapp, an English botanist and author of a work on grasses. It is variously entitled by British and foreign writers.

KNAPPIA AGROSTIDEA. Dwarf Knappia. PLATE CXXXIX.

Knappia agrostidea, *Smith. E. B.* 1127; ed. 2. 187. *Hooker and Arnott. Babington. Parnell.* Chamagrostis minima, *Borkhausen. Lindley. Bentham.* Mibora verna, *Beauvois.* Sturmia minima, *Hoppe.* Agrostis minima, *Linnæus.*

One of the smallest of the grass family, being seldom more than about two inches in height. As a British species it may be regarded as a rarity, being chiefly confined to the south-west shores of Anglesea, and those of the Channel Islands. It grows in a tufted form, sending up several smooth, slender, thread-like stems from the same root. Leaves short, linear, rather obtuse, rough; their sheaths about equal to them in length, thin, whitish, inflated. Ligule obtuse, crenate, stem-clasping. Inflorescence from a quarter of an inch to nearly an inch in length. Spikelets in two rows on opposite sides of the rachis, but inclining to one side, shortly pedicellate, sufficiently so to render the inflorescence rather racemose than spicate, one-flowered; from four or five to ten on each apparent spike. Glumes two, equal, smooth, dorsally compressed, truncate, green down the back, but having the sides more or less tinged with purple, longer than the included flower. Palea mostly solitary, but sometimes including at its base the opposite rudiment of a second, hairy, obtuse, and jagged at the apex, whitish, very thin and delicate.

Annual. Flowers in March and April, ripening its seed, and dying off about the end of May, or the first week in June. Like many other short-lived annual plants that flower early in the spring, a second crop may occasionally be met with in the autumn.

Genus 47. SPARTINA. Cord Grass.

GEN. CHAR. Inflorescence a more or less compound spike; partial spikes erect. Spikelets laterally compressed, sessile, one-flowered, arranged alternately in two rows on one side of the zigzag, partial rachis. Glumes two, very unequal, lanceolate, compressed. Paleæ two, unequal, lanceolate-acuminate, compressed. Styles elongated, united half-way up. Stigmas plumose.

The genus is a small one, consisting of eight or ten species, chiefly American and western European, growing in muddy salt marshes, and about the estuaries of rivers. They are harsh, unpalatable grasses,

destitute of agricultural value, and, indeed, almost beyond the pale of cultivation.

The name is of doubtful origin, but is supposed to have been adopted from the resemblance in habit between these grasses and the *Lygeum Spartum*, the Bass-weed, or Cord-grass of Spain; *esparto* being a general name in that country for grasses used in manufacturing ropes, baskets, nets, &c. The Greek *sparton* seems to have had some similar general signification.

SPARTINA STRICTA. Twin-spiked Cord Grass. PLATE CXL.

Partial spikes two or three, appressed, erect; their rachis angular, smooth, scarcely extended beyond the terminal spikelet. Glumes hairy; the inner and larger one single-veined. Outer palea hairy, single-veined; inner one much longer, delicately two-veined. Leaves articulated with their sheaths; the uppermost (usually) shorter than the spikes.

Spartina stricta, *Smith. E. B.* ed. 2. 190. Generally adopted.
Dactylis stricta, *Linnæus. Knapp. Withering. E. B.* 380.
D. cynosuroides, *Hudson.*

Not unfrequent in muddy salt marshes on the eastern and south-eastern shores of England, especially near the mouths of rivers. Whole plant remarkably rigid. Root more or less creeping. Stems from six or eight inches to a foot and a half high; completely invested by the sheathing bases of the leaves, the uppermost of which extends to immediately below the inflorescence. Leaves comparatively short, pungent, more or less involute, very rigid; often contracted at the base, where they join the sheath, so as to form a spurious articulation at which they readily separate. Inflorescence sometimes simply spicate; but more commonly consisting of two or even three spike-like branches connected at the lower part, erect and parallel. Rachis angular, smooth. Spikelets laterally compressed, sessile, arranged alternately in two series on the same side of the rachis; five to ten on each partial spike, bearing individually one perfect flower and occasionally the rudiment of a second. Glumes very unequal, the outer one much the smaller; both hairy, and without any lateral veins. Paleæ very unequal; the outer smaller, hairy, and with only a dorsal vein; the inner two-veined, longer than the larger glume.

Perennial. Flowers in August.

Far too rigid to be eaten by cattle; but valuable as a colonizer and land-former in the situations where it flourishes, contributing largely towards fixing and rendering solid the mud-flats that accumulate about the mouths of rivers on low coasts. A brackish condition of the mud-water or frequent sprinkling from the sea-spray seems essential to its vegetation, as I have experienced in my frequent attempts to naturalize it in the botanic garden.

SPARTINA ALTERNIFLORA. Many-spiked Cord Grass. PLATE CXLI.

Partial spikes many (four or more), erect, more or less appressed; their rachis angular, smooth, extended beyond the spikelets as a long flexuose awn-like point. Outer and smaller glume glabrous; inner and larger one five-veined, glabrous except on the middle or keel-vein, which is fringed with distant short bristles. Outer palea three-veined, not hairy; inner one longer, thin, acute. Leaves continuous with their sheaths; the uppermost equal to, or longer than, the spikes.

Spartina alterniflora, *Loisel. E. B.* Supp., 2812. Most modern British botanists. S. glabra, *Muhl.* S. lœvigata, *Link.*

Found abundantly on the mud banks and flats of the Itchen and Southampton rivers. A much larger and stronger growing grass than *Spartina stricta.* Root sending out long creeping under-ground shoots or stolones. Stems a foot and a half to two or three feet high, covered throughout with the investing leaf-sheaths. Leaves often a foot or more in length, and in luxuriant specimens from half to three quarters of an inch in breadth at the lower part, where they are never contracted nor present any appearance of articulation, like those of the preceding species. Inflorescence a more or less compact or spike-like panicle, consisting of from four or five to ten or twelve erect secondary or partial spikes, the upper ones springing like the pedicels of a raceme one above another from the main rachis; which latter, as well as the partial ones, always extends considerably beyond the uppermost spikelet as a terminal awn-like point. The spikelets, with their glumes and the paleæ of the solitary flower, are not very dissimilar at the first glance from those of *S. stricta;* but the glumes and paleæ are not hairy, indeed perfectly smooth, with the exception of a few distant bristles on the keel-vein of the longer glume. In addition to this difference it will be remarked, that the inner or upper glume is five-veined and the outer palea three-veined, instead of being both only single-veined as they are in the latter species. The comparatively greater length of the uppermost leaf is a feature of doubtful importance, being liable to considerable variation.

Perennial. Flowers in August.

When recently gathered, this grass has a peculiarly fœtid odour much resembling that of phosphurated hydrogen gas. Dr. Arnold Bromfield, who furnished the description and the specimen figured in the English Botany Supplement, informs us that "in spite of its rank smell, it is greedily devoured by pigs and horses, and is extensively used both as litter for cattle and for thatching by the poorer classes about Southampton."

There are so many features of general resemblance between this grass and the preceding, and those of obvious distinction are of a class so liable to variation under difference of locality and other circum-

stances, that it is difficult, for one accustomed to the close investigation of specific characters, to believe that the one before us has claim to be considered otherwise than as a very luxuriant form of its congener. Mr. Bentham assures us that "in North America, where it is frequent, it passes gradually into the more common form;" and I have seen Southampton specimens which it would be impossible to regard in any other light than as intermediate varieties. Dr. Bromfield mentions *S. alterniflora* as having been met with on the banks of the Adour near Bayonne, on the coast of France.

The rank odour above referred to is by no means peculiar to this American species or variety, whichever it may be, being not at all uncommon to plants vegetating in similar localities, and, though unnoticed by authors as a property of *S. stricta*, that grass will be found, when first collected, to be almost equally unpleasing to the nostrils.

Genus 48. CYNODON. Dog's-tooth Grass.

Gen. Char. Inflorescence a digitate, umbellate, or racemose cluster of spreading, linear spikes. Spikelets nearly sessile, equidistant in a single row on one side of the rachis, laterally compressed, one-flowered (occasionally with a superior rudiment of a second flower). Glumes two, nearly equal. Paleæ two, compressed; the lower boat-shaped, eventually hardening around, and enclosing the caryopsis (fruit). Styles distinct.

A small, but widely distributed genus, separated from *Panicum*, to which the typical species, *Cynodon Dactylon*, was referred by Linnæus. Named from the Greek *cyon*, a dog, and *odous*, a tooth, adopted by Persoon, probably as characteristic of the arrangement of the leaves in the creeping, barren shoots, as seen spreading over the surface of the soil. The rudiment of the second flower in the spikelet is usually a mere filament, proceeding from the outer base of the external palea, and occasionally either thickened or bearing a minute scale at its apex. From its position this filament may be regarded as an extension of the floral axis, and the terminal scale as the rudimentary palea of another flower, which is therefore superior or above the perfect one. This explanation is important in a physiological point of view, but unnecessary to the recognition of the genus.

Cynodon dactylon. Creeping Dog's-tooth Grass. Plate CXLII.

Clusters of from three to six spikes. Outer palea longer than the glumes, smooth, slightly ciliated on the keel and margins. Leaves downy beneath; those of the creeping barren shoots flat, spreading; those of the culms usually folded inward.

Cynodon dactylon, *Persoon. E. B.* ed. 2. 188. Modern botanists generally. Panicum dactylon, *Linnæus. E. B.* 850. *Withering. Knapp.*

Rare as a British grass, being only met with on the sandy sea-shores of the south-western counties of England; on those about Penzance, in Cornwall, it grows most abundantly, and has been found in a few scattered localities on the English Channel coasts of Devonshire and Dorset, but not farther east than Studland in the latter county. A low, creeping grass, spreading extensively at the root by sending out long cord-like stolones that fix themselves firmly in the loose sand by producing at every joint a cluster of strong radicle fibres. The flowering stems are seldom more than four or five inches in height, springing here and there from the prostrate barren leaf shoots, that, branching and rooting as they extend, cover the soil with a compact network. Leaves flat, except on the culms, where they are generally folded, but not involute, rather short, acute, somewhat hairy. Ligule absent, or only represented by a tuft of hairs at the top of the sheath; which latter eventually opens, leaving the culm exposed. Spikes of the inflorescence linear, an inch to two inches in length, usually four or five, spreading like the stalks of an umbel, but always to one side; occasionally two or three branch out from a common rachis, when the inflorescence assumes the form of a racemose panicle. Spikelets laterally compressed, purplish, variable in number, often ten or twelve on each spike, equidistant, nearly sessile, unilateral, with only one perfect flower. Glumes acute, the outer one rather smaller, bristly on the upper part of the mid-vein or keel, shorter than the flower. Outer palea large, smooth, but ciliated on the margins and midvein.

Perennial. Flowers from July to September.

A maritime grass, common on all the coasts of southern Europe, and the islands and basin of the Mediterranean, where it is among the most efficient of the class of sand-binders, covering the surface of the loose material, with its dense and rapidly-forming network, as well as interlacing it below. In England, as indicated by its very local distribution, it can only be regarded as a naturalized species, and as one not very likely to extend its habitats much northward. It is strictly a denizen of warm latitudes, and evidently incapable of withstanding the effects of excessive cold and moisture; as in the neighbourhood of London it suffered, last winter (1860-61), almost equally with *Arundo Donax*, *Tripsacum dactyloides*, and other semi-tropical plants of the order. Either the same or certain very nearly allied species is found both in the East and West Indies; in the former *Cynodon linearis*, regarded by some persons as identical with *C. Dactylon*, is one of the most common and valuable of fodder grasses, known as the Durva or Doorba grass of Hindustan; and Dr. Parnell mentions his having received authentic specimens of that now before us from Jamaica.

Genus 49. DIGITARIA. Finger Grass.

Gen. Char. Inflorescence an umbellate or racemose cluster of spreading, linear spikes. Spikelets unequally pedicellated, in pairs on one side of the flattened rachis, dorsally compressed, one-flowered, with an inferior rudiment of a second. Glumes two; the lower or outer one usually very small, or even obsolete; the upper one three-veined. Paleæ, of the upper or fertile flower, two; eventually hardening around and inclosing the caryopsis. Styles distinct. Barren flower almost as large as the fertile one.

Named from the Latin *digitus*, a finger, in allusion to the finger-like arrangement of the spikes of inflorescence.

A genus, of annual grasses chiefly, very widely distributed in the warmer regions of both hemispheres. The British species are only accidental intruders as weeds of cultivation. With the exception of *D. sanguinalis*, cultivated for the use of its seeds in some parts of Germany, these grasses are not of any agricultural value.

Digitaria was originally confounded by Linnæus, like *Cynodon*, *Setaria*, &c., with his unwieldy and diversified genus *Panicum*, from which it is at once distinguished by the remarkable form of the inflorescence: in this respect it approaches *Cynodon*, but comparison of the above generic characters will prevent the possibility of mistake. It should be observed, that the rudiment of the second flower in each spikelet is a very conspicuous object, consisting of a large flat, five-veined palea, often equalling in size the upper glume, and very unlike the simple clavate or spathulate hair which represents it in the foregoing genus, *Cynodon*.

Digitaria sanguinalis. Hairy Finger Grass. Plate CXLIII.

Clustered spikes three to six or more, linear, spreading. Rachis flattened, flexuose, the margins minutely serrulate. Spikelets oblong-lanceolate. Lower glume minute, very acute; upper one lanceolate, three-veined. Culm creeping and branching at the base. Leaves and sheaths hairy.

Digitaria sanguinalis, *Scopoli*. *E. B.* ed. 2. 189. Most modern English botanists. Panicum sanguinale, *Linnæus*. *E. B.* 849. *Withering*, *Bentham*. Syntherisma vulgare, *Schrader*.

Occasionally met with in old garden ground in a silty or sandy soil. About forty years since, both this and the next species, *D. humifusa*, grew most abundantly in the asparagus beds of the Battersea market gardens; but I have never found it elsewhere, unless in living botanical collections. Mr. Borrer, as quoted by the authors of the 'British Flora,' considers that the other native habitats given for the

species, belong to *D. humifusa*. Stems, several from the same root, branched, decumbent, and rooting at the base, from a span to eighteen inches or two feet high, smooth, striated. Leaves flat, rather short, oblong-lanceolate, acute, rough, with hairs on both sides; the hairs springing from small tubercles, very distinctly seen upon the sheaths. Clustered spikes usually four or five, but sometimes in very luxuriant specimens ten or more. Spikelets in pairs, supported by pedicels of very unequal length, and more or less appressed to the same side of the flattened rachis, two-flowered. Lowermost barren flower consisting of a single large, oblong-lanceolate palea, five-veined, and pubescent on the margins. Upper fertile flower, with two equal paleæ, more or less tinged with purple.

Annual. Flowers in August and September.

Very widely distributed in warm and tropical countries, in many of which it is a common and troublesome weed in arable land; as, though an annual and short-lived plant, the stems are at first decumbent, and, taking root at the lower joints, send up others of similar habit, occasioning it to increase rapidly and occupy a large space. According to Mr. Sinclair, "in some parts of Germany this grass is cultivated for its seed, which, when boiled with milk or wine, is said to form an extremely palatable food, and is generally made use of whole in the manner of sago, to which it is in most instances preferred. It produces much seed, of which birds are very fond, and requires to be protected by nets or otherwise during the time of ripening. The usual method of collecting and preparing the seeds is, that at sunrise they are gathered or beaten into a hair-sieve from the dewy grass, spread on a sheet and dried for a fortnight in the sun; they are then gently beaten with a wooden pestle in a wooden trough or mortar, with straw laid between the seeds and the pestle, till the chaff comes off; they are then winnowed. After this they are again put into the trough in rows, with dried marigold flowers, apple and hazel leaves, and pounded until they appear bright; they are then winnowed again, and being made perfectly clean by this last process, are fit for use. The marigold leaves are added to give the seeds a fine colour. A bushel of seed with the chaff yields only about two quarts of clean seed."

DIGITARIA HUMIFUSA. Smooth Finger Grass. PLATE CXLIV.

Clustered spikes two to four, linear, spreading. Rachis flattened, nearly straight, the margins minutely serrulate. Spikelets oval or oblong. Lower glume very minute, truncate, often absent altogether; upper one oblong, three- or five-veined, nearly the length of the fertile flower. Culm decumbent at the base. Leaves and sheaths glabrous.

Digitaria humifusa, *Persoon*. *E. B.* Supp., 2613. *E. B.* ed. 2. text, page 78. Most modern English botanists. Panicum glabrum, *Koch*. *Gaudichaud*. *Bentham*. P. humifusum, *Kunth*. Digitaria filiformis, *Koel*. Syntherisma glabrum, *Schrader*.

More frequently met with than the preceding, in cultivated ground, in various parts of England, but not indigenous. It prefers a light sandy soil. A much smaller plant than *D. sanguinalis*, for which it seems to have been frequently mistaken. Stems from a few inches to near a foot in height, decumbent and spreading, but with little tendency to root. Leaves flat, short, rather broad, rough at the margins, but not hairy. Clustered spikes usually three or four. Spikelets ovate, sometimes three together, shortly pedicellate. The whole plant is occasionally more or less tinged with purple when in flower.

Annual. Flowers in July and August.

Botanists in general seem inclined to regard this .a distinct species, and there are differences between them, that in many other genera among the grasses would be considered decisive of the fact. The result of several years' cultivation of the two in my own garden induces me to entertain a different opinion; they pass through intermediate forms into each other. Linnæus, it would seem, was not acquainted with the plant to which the specific name *sanguinalis* is now given, which is not found in Sweden, his *Panicum sanguinale* being our *Digitaria humifusa:* this fact will account for the title that appears so much at variance with the aspect of the former, and which has led some authors to gravely quote a very ludicrous interpretation of the same to reconcile the inconsistency. The deep purple hue, often assumed by the grass before us, resembling blood stain, might well lead to the name in question, but could have no relation to its congener; concerning which we are told that, "*D. sanguinalis* has its specific name, not from the colour as might be supposed, but from an idle trick which the boys, in some parts of Germany, have of pricking one another's nostrils with its spikelets until they bleed!"

ERRATA.

Apart from a few minor typographical errors in orthography and punctuation, not interfering with the general sense of the passages in which they occur, the reader is requested to attend to the following :—

Page 11, line 3 from bottom. Fig. c. plate X. only represents the pistil.
20, line 18. For *than most*, read *than in most.*
25, line 11. For *flower*, read *flour.*
72, line 7. The little leafy bulb referred to on plate LVIII. was omitted in the engraving.
73, For *Mr.* read *Dr.* Parnell.
110, line 33. For *state*, read *states.*
111, last line. Take out commas after *inflorescence* and *dissimilar.*
122, line 27. For *B. mollis, B. velutinus*, read *B. mollis, β. velutinus.*
128, line 24. Take out comma after *cereal.*
140, last line. For *oppressed*, read *appressed.*
149, line 13. Take out commas after *maritime* and *meadow.*
151, line 10. For *fistula*, read *fistular.*
160, line 25. For *mildewed*, read *mildew.*
162, line 9. For *Rushey*, read *Rushy.*
162, line 19. For *faces*, read *surface.*

ALPHABETICAL

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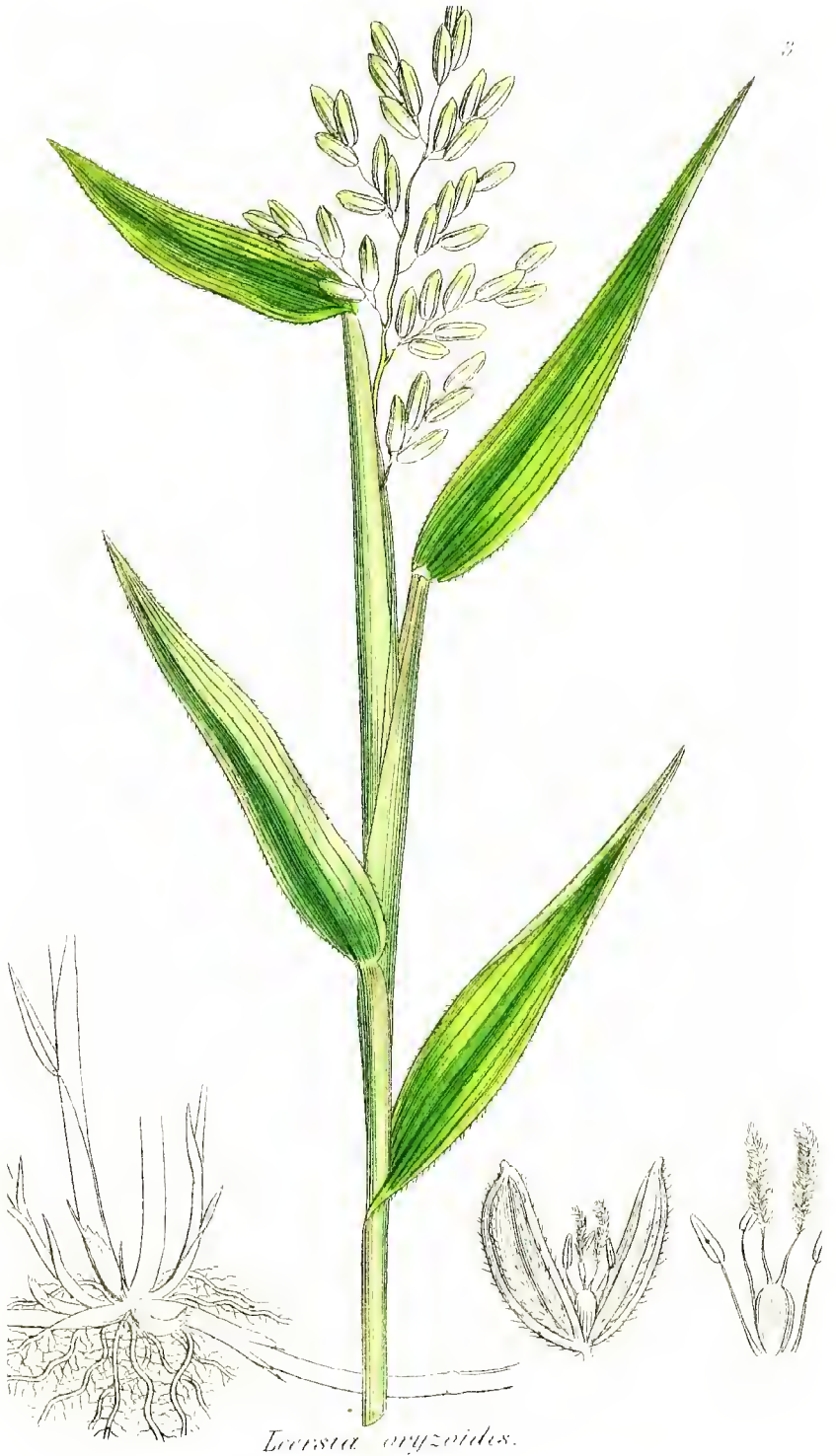
THOMAS PIPER, PRINTER, PATERNOSTER ROW.

Anthoxanthum odoratum.

Nardus stricta.



Leersia oryzoides.

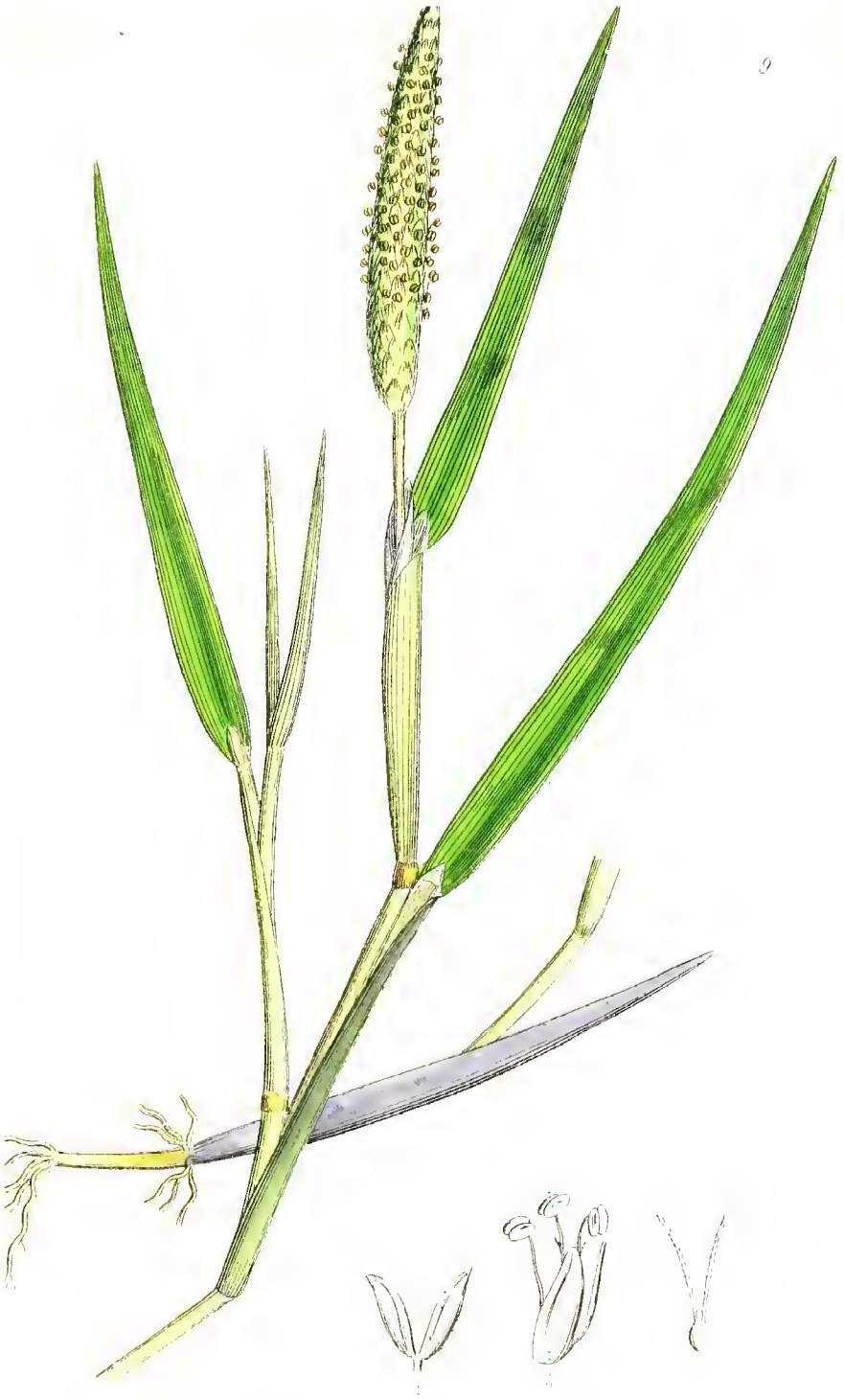
Alopecurus pratensis.

Alopecurus alpinus.

Alopecurus agrestis.

Alopecurus bulbosus.

Alopecurus geniculatus



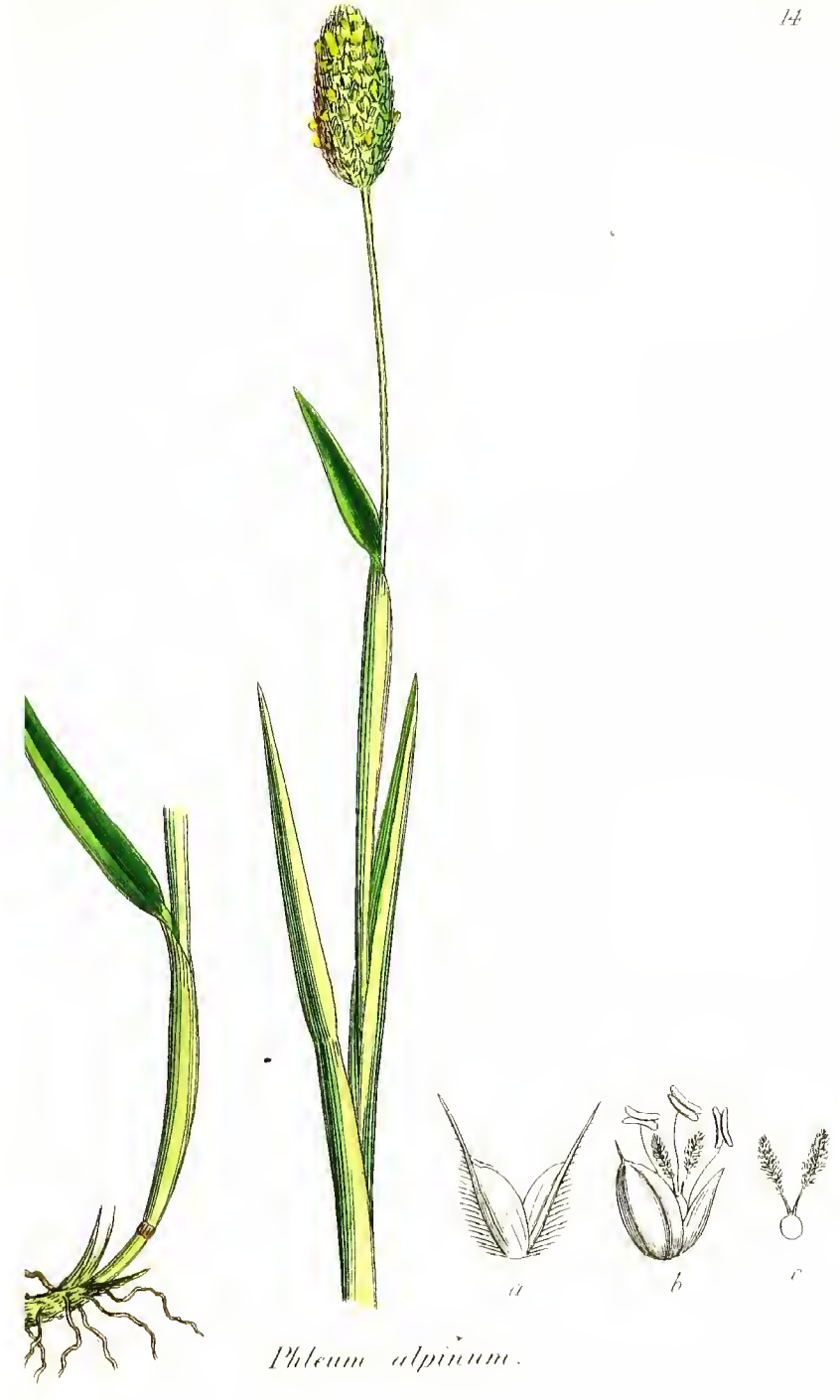
Alopecurus fulvus.

Phalaris canariensis

Phalaris arundinacea

Ammophila arundinacea

Phleum pratense.



Phleum alpinum.

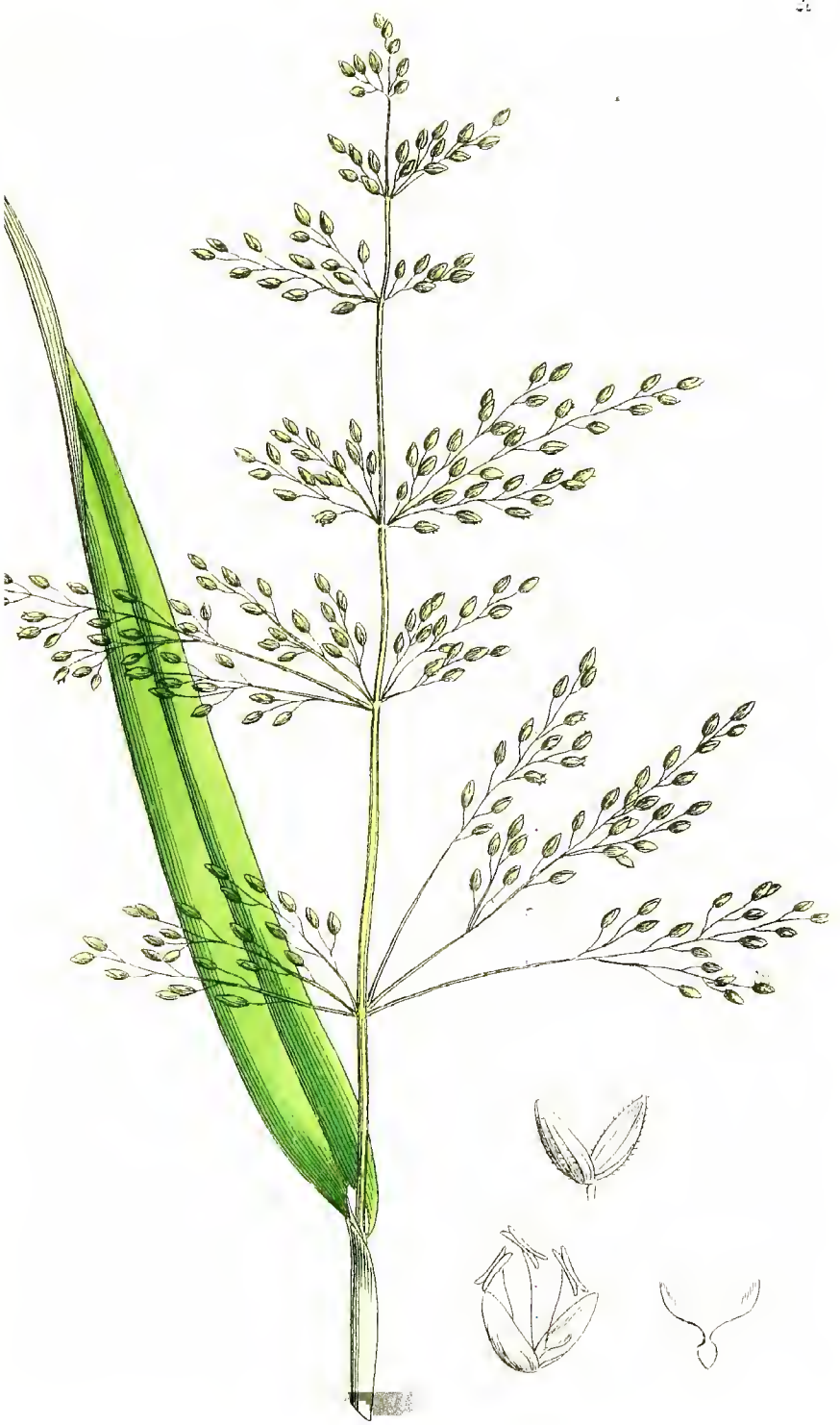
Phleum asperum.

Phleum Boehmeri

Phleum Michelii

Phleum arenarium.

Langurs ovatus.



Milium effusum.

Gastridium lendigerum.

Stipa pennata

Polypogon monspeliensis.

Polypogon littoralis.

Calamagrostis Epigejos.

Calamagrostis lanceolata.

Calamagrostis stricta.

Agrostis canina

Agrostis setacea.

Agrostis vulgaris.

Agrostis alba.

Agrostis stolonifera.

Apera Spica-venti.

Apera interrupta.

Catabrosa aquatica.

Aira arenitosa

Aira alpina

Aira flexuosa.

Aira caryophyllea.

Aira præcox.

Corynephorus canescens.

Molinia cærulea

Melica nutans.

Melica uniflora

Holcus mollis.

Holcus lanatus.

Arrhenatherum avenaceum.

Hierochloa borealis.

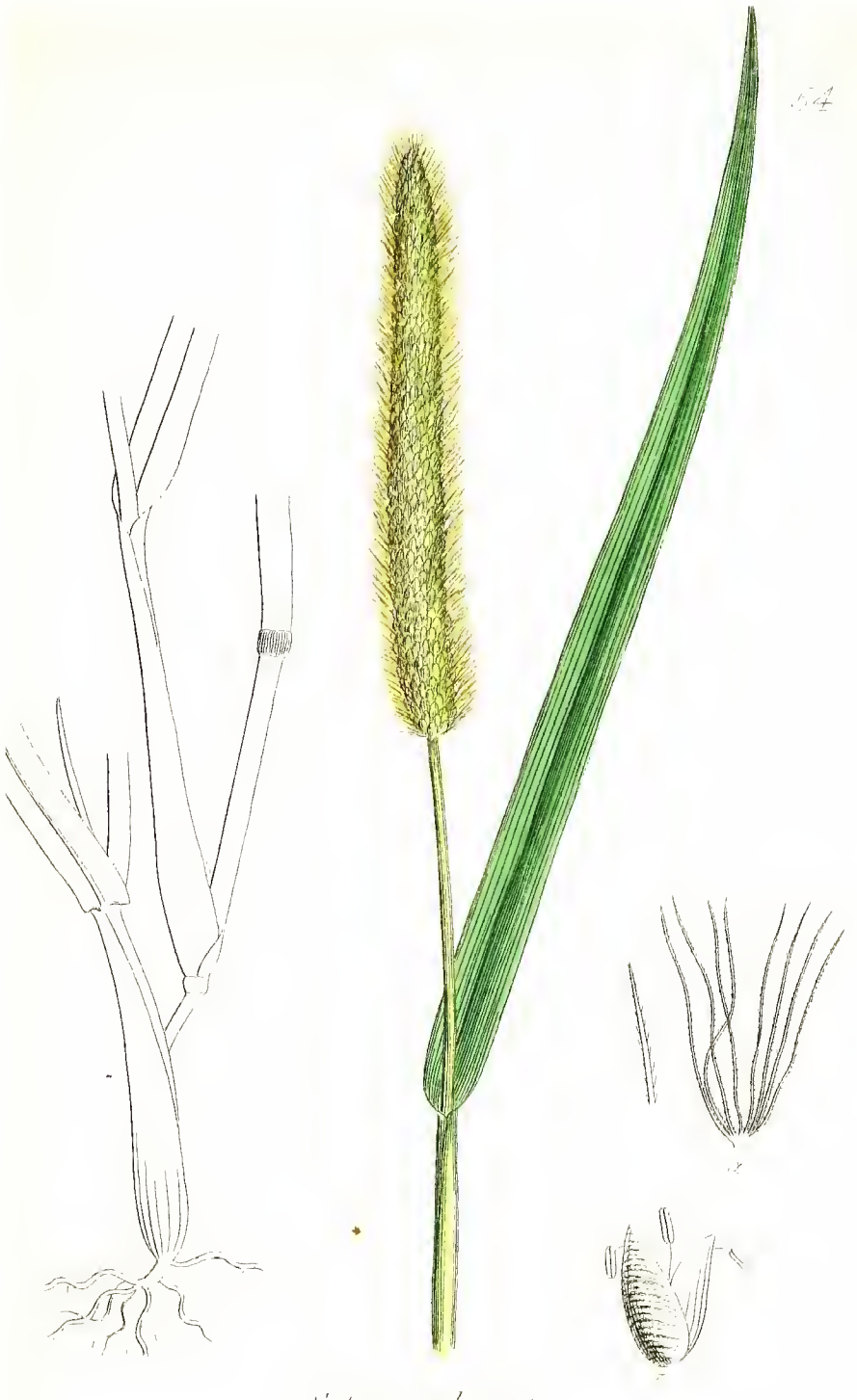
Koeleria cristata

Sesleria caerulea

Panicum Crus-galli

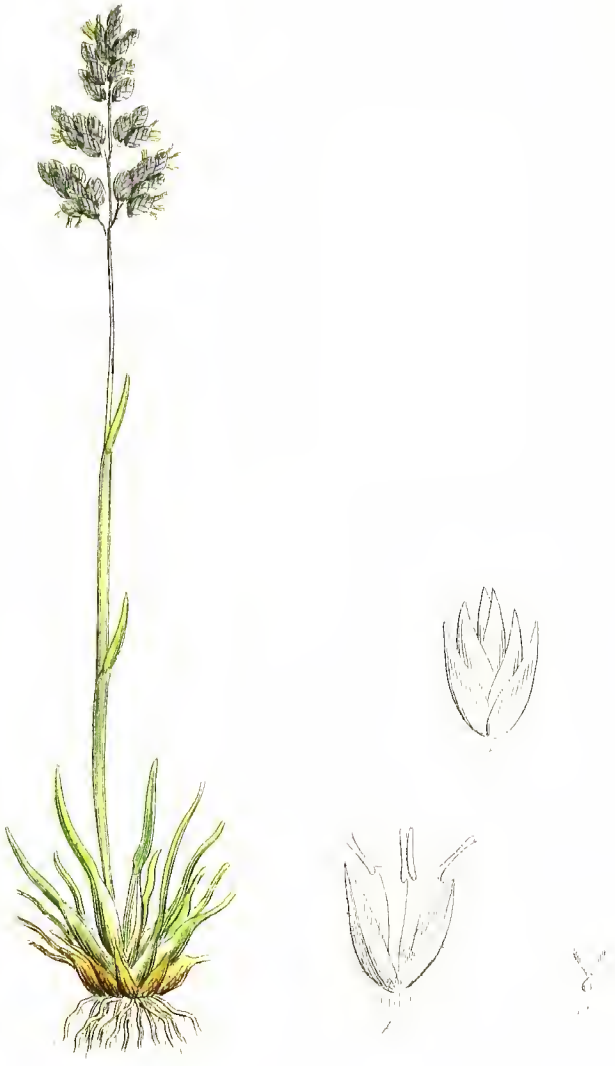
Setaria verticillata

Setaria viridis



Setaria glauca

Poa annua.



Poa bulbosa.

Poa laxa

Poa alpina.

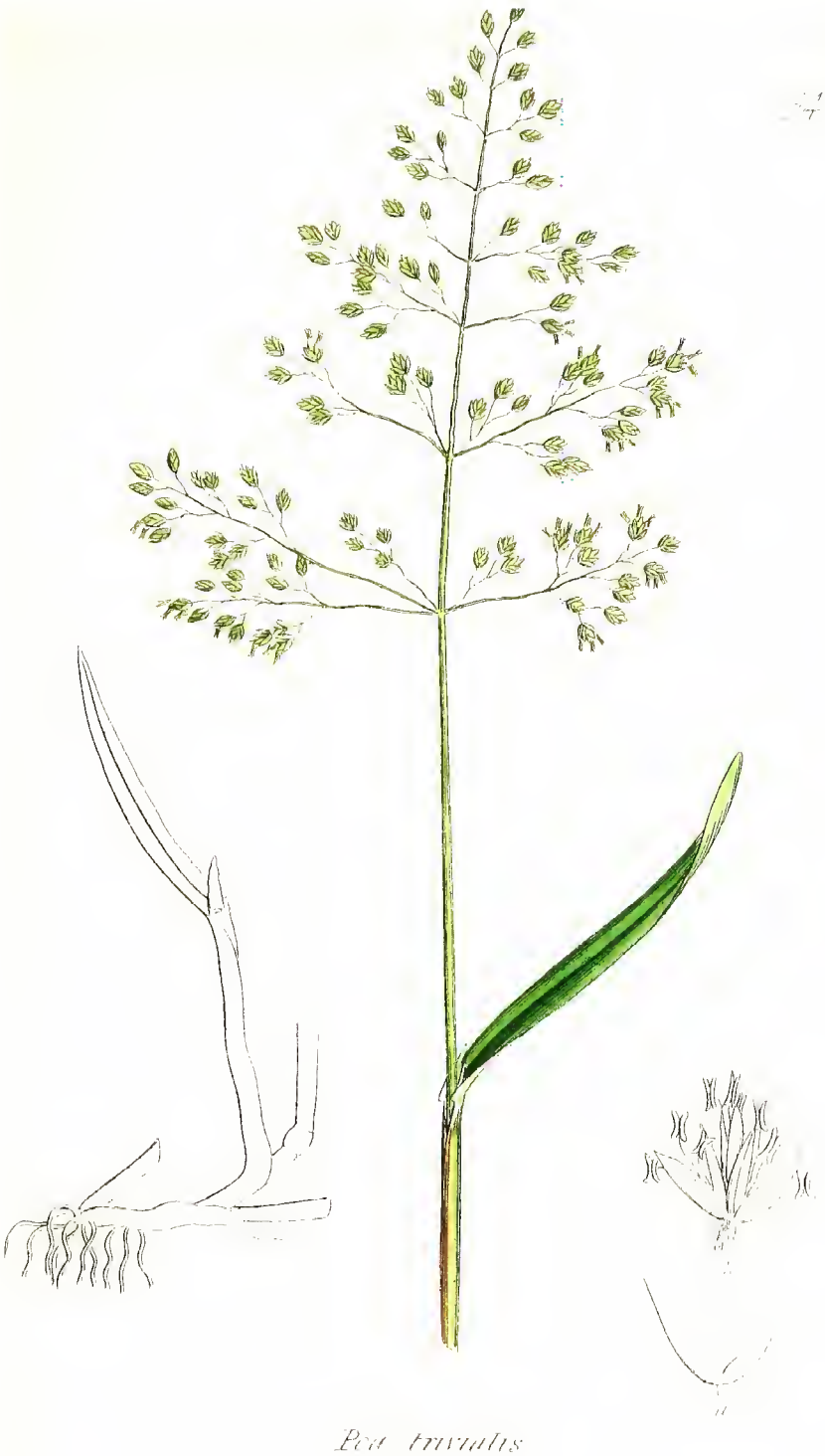
Poa caesia

Poa nemoralis

Poa Parnella

Poa Balfourii

Poa Glauca



Poa trivialis

Poa pratensis.

Poa subcerulea

Poa Compressa

Selerochloa maritima.

Sclerochloa distans

Sclerochloa Borreri

Sclerochlea procumbens

Scleroclilea rigida

Sclerochloa loliacea.

Glyceria aquatica

Panicum flavitum

3

2

Trividia decumbens

Briza media

Briza minima

Dactylis glomerata

Cynosurus cristatus.

Cynosurus echinatus.

Festuca uniglumis

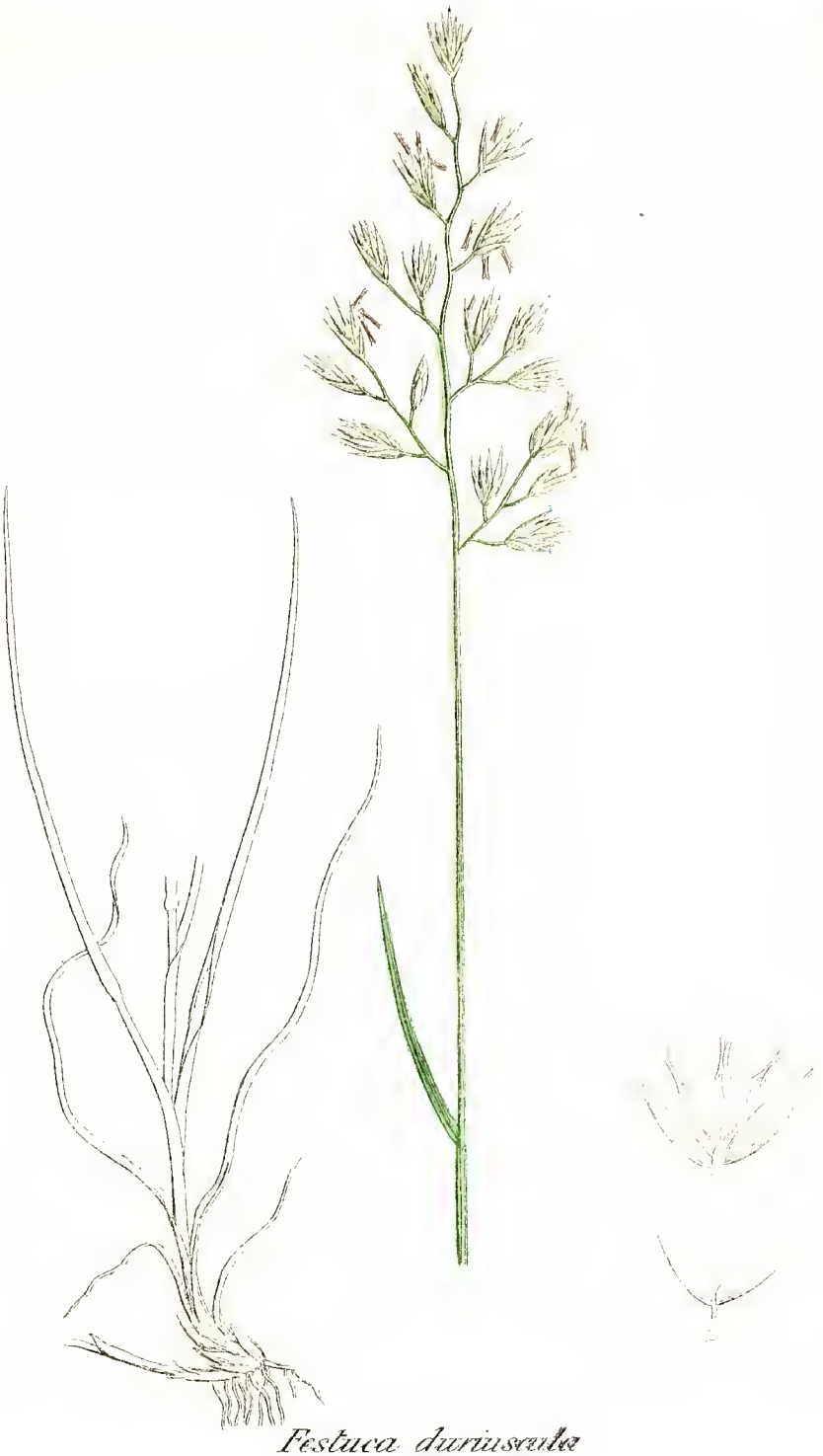
Festuca sciuroides

Festuca myuros

Festuca ovina

Festuca vivipara

Festuca caesia



Festuca duriuscula

Festuca rubra

Festuca sylvatica

Festuca dactylon

Festuca pratensis

Festuca elatior

Festuca elongata

Festuca triflora

Festuca loliacea

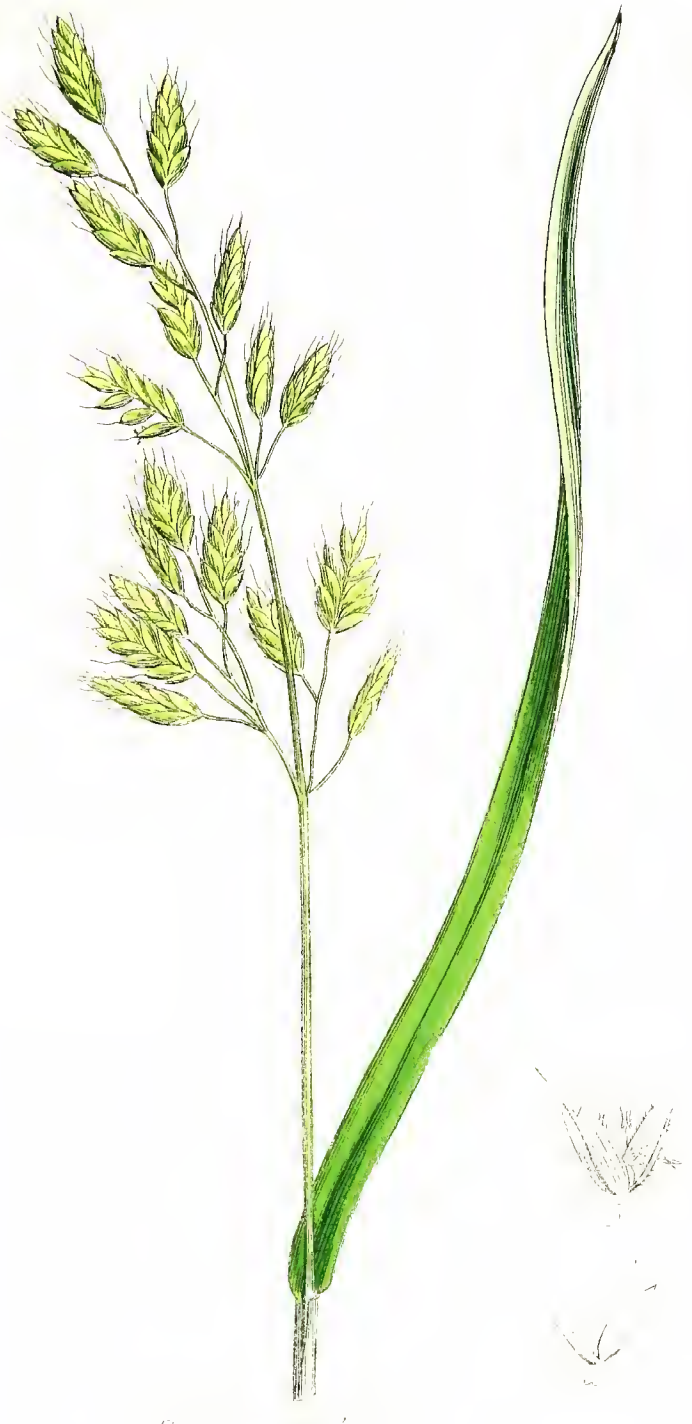
Bromus erectus

Bromus asper

Bromus sterilis.

Bromus diandrus.

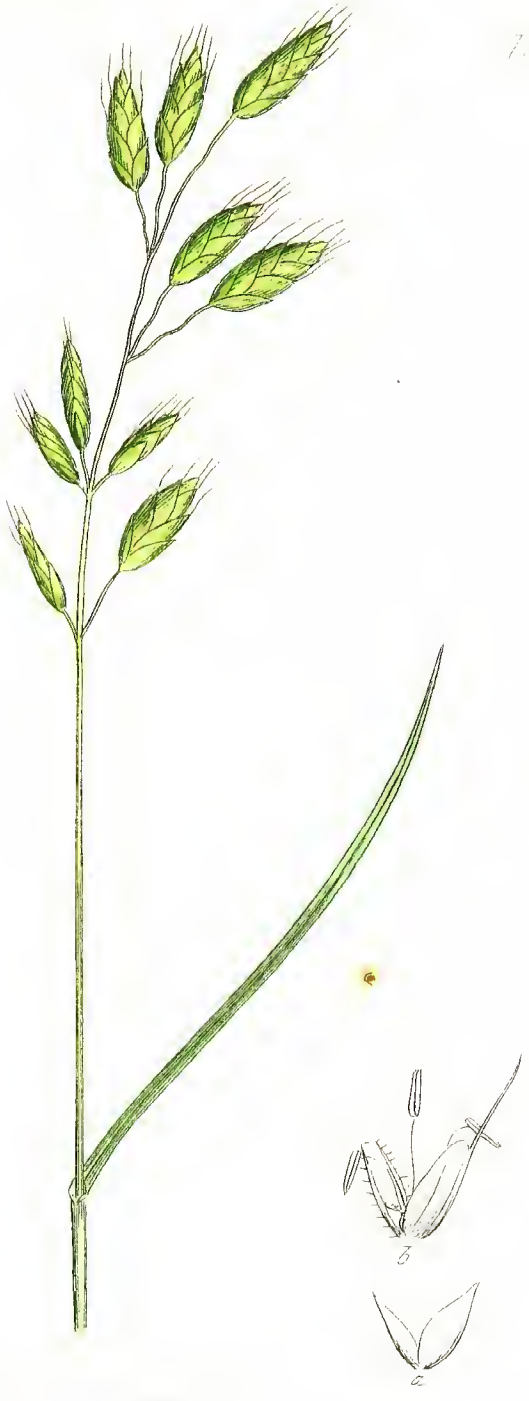
Bromus inermis.



Bromus secalinus.

Bromus velutinus.

Bromus commutatus



Bromus racemosus.

Bromus mollis.

Bromus arvensis.

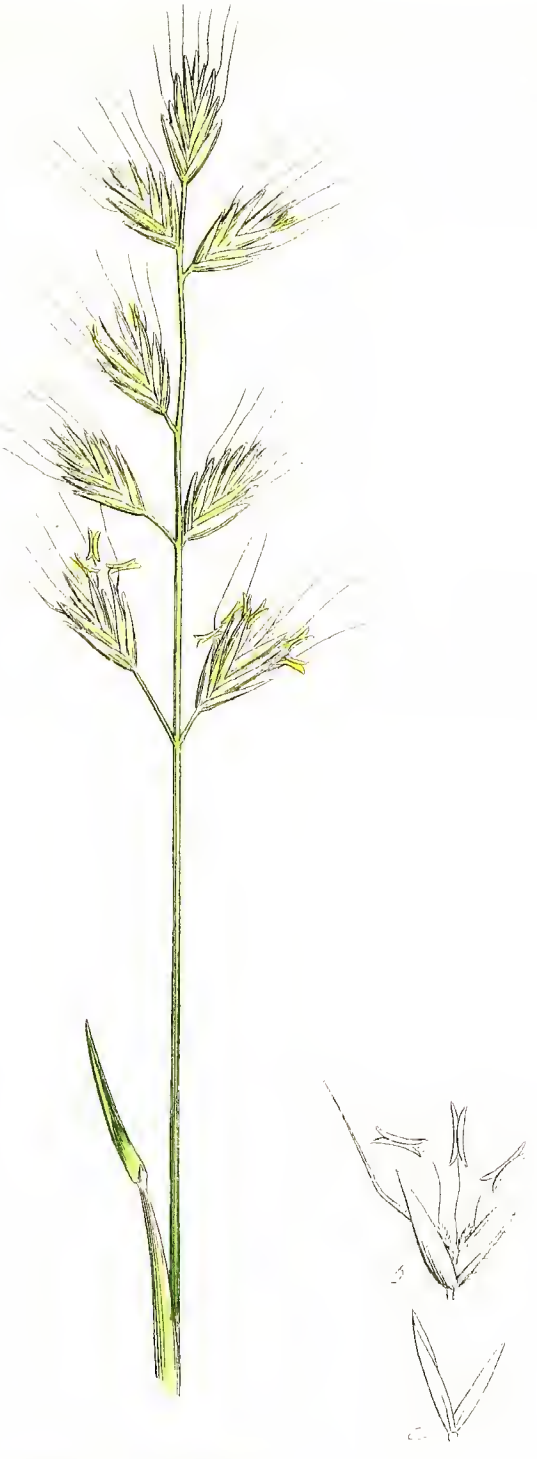
Bromus squarrosus.

Avena fatua.

Avena sativa.

Avena crinitalis

Avena strigosa



Avena pratensis.

Avena alpina

Avena planiculmis

Avena pubescens

Avena flavescens.

Phragmites communis.

Elymus arenarius.

Elymus geniculatus.

2

1

Hordeum distichum. Fig 1.
Hordeum hexastichum. Fig 2

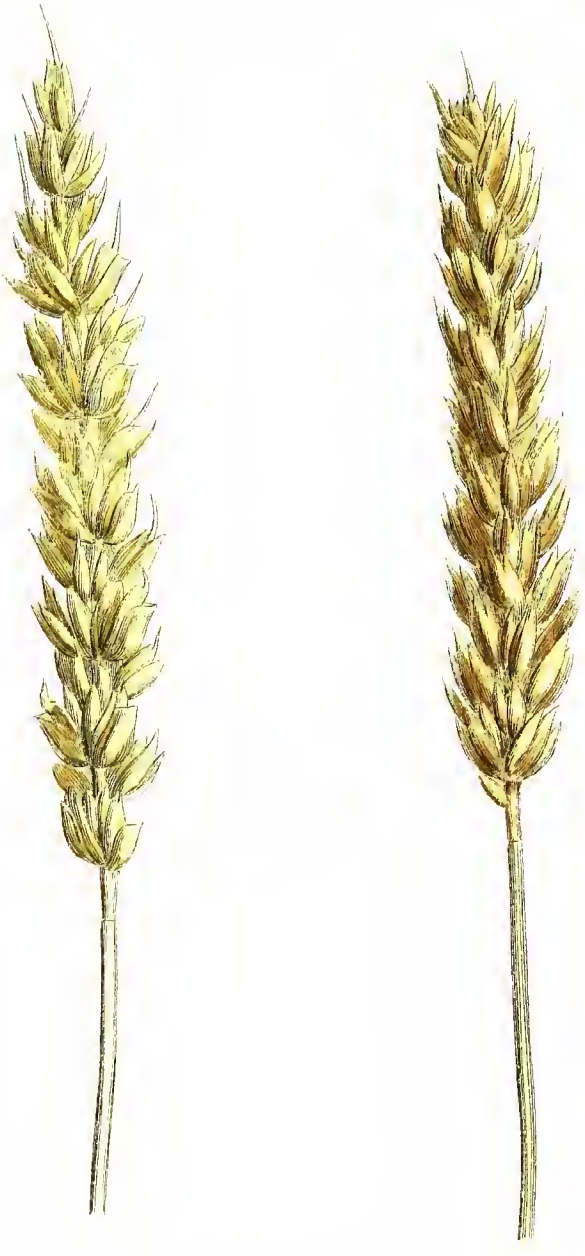
Hordeum pratense.

Hordeum murinum

Hordeum maritimum.

Hordeum sylvaticum.

Secale cereale



Triticum sativum

Triticum compositum

Triticum cristatum

Triticum junceum.

Triticum repens.

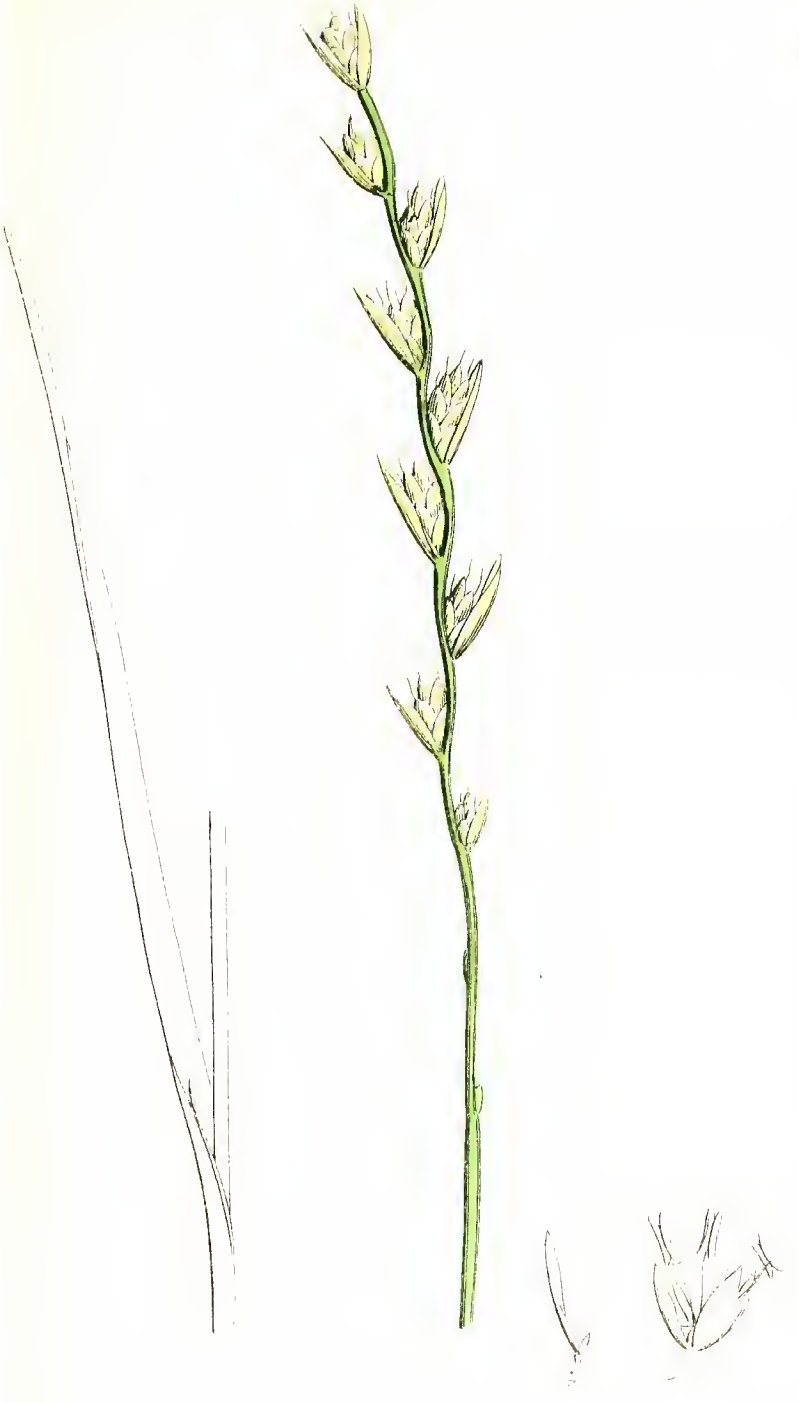
Triticum caninum.

Brachypodium sylvaticum

Brachypodium pinnatum.

Lolium perenne.

Lolium temulentum



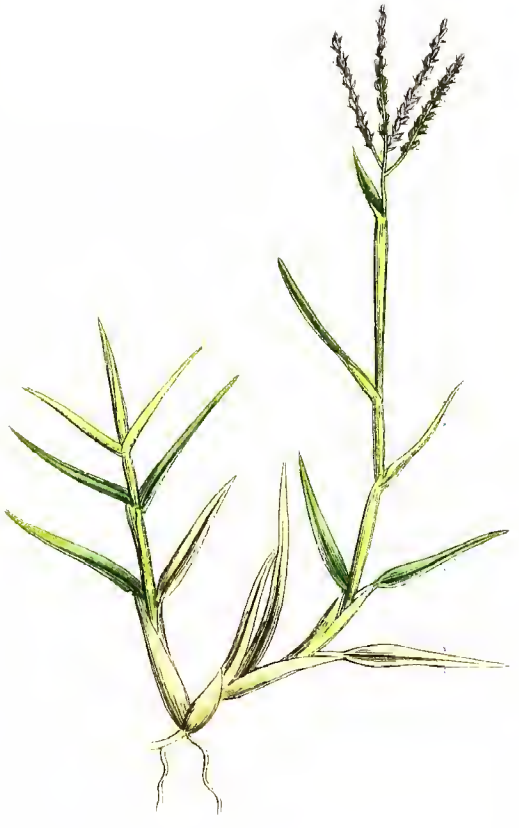
Lolium arvense.

Lepturus incurvatus.

Knappia agrostidea

Spartina stricta.

Spartina alterniflora



Cynodon dactylon.

Digitaria sanguinalis

Digitaria humifusa